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A NEW  
THEORY  
OF  
ACUTE and SLOW  
*Continu'd FEVERS:*

WHEREIN,

Besides the Appearances of such, and the Manner of their Cure, occasionally, the Structure of the *Glands*, and the Manner and Laws of *Secretion*, the Operation of *Purgative*, *Vomitive*, and *Mercurial Medicines*, are Mechanically Explained.

To which is prefixed,

An ESSAY  
CONCERNING THE  
IMPROVEMENTS of the  
THEORY of MEDICINE.

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*The Sixth Edition, Corrected.*

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*Te capiet magis.* — *si propius stes,*  
Horat. De Arte Poët.

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T H E  
P R E F A C E.

**T**O write any thing tolerable about Fevers, or any thing worse than what has already been advanced by some one or other on the Head, is perhaps no easy Matter. The ridiculous Manner of accounting for their Causes and Symptoms, used by some Pretenders to Medicine and Philosophy, has perhaps contributed (in its way) to that Contempt, to which (with such Expence of Satire and Wit) they and their Art have been expos'd.

I have not the Arrogance to think the few following Sheets will conduce any thing to wipe it off; but of this I am sure, if this Theory prove false, the Choices behind are fewer by one of the true Kind, which endeavours to account from their Appearances from Mechanick Principles.

The wiser Part of Mankind are now persuaded, That this Machine we carry about, is nothing but an Infinity of branching and winding Canals, filled with Liquors of different Natures; and I am mightily out in my Conjectures, if for the future any be heard about



Theories of Diseases, or the Manner of the Operation of Medicines, who do not reason from these Data, and their necessary Consequences. And seeing Continual Fevers are only a Complication of Symptoms, which naturally follow upon a general Obstruction of these Canals (or the Glands which they constitute) and the necessary Effects thereof, as I reckon; None I hope will be angry, I have called such a Manner of accounting for them, New, seeing for any thing I know (as to the main thereof) it is really so.

For the Structure of the Glands, and the Business of Secretion, the Foundation is Bellini's, but I hope it has lost nothing in my Hands. I have added some Things, extended others, and made all plain and consequential.

As to the other Things here occasionally explained, which, adding what Bellini has advanced about Blood-Letting, make up the great and principal Operations performed by Medicines on animal Bodies; I have very frankly borrowed what of them I found for my Purpose from Borelli, the aforesaid Bellini, and another Gentleman, whom I reckon the Ornament of his Profession and our Country: But for the most Part, pointing at Place and Person. And I shall reckon my self no more a Plagiary for this than a Lawyer is to be accounted one for quoting his Code, or Pandects.



*The Occasion of entring upon these Thoughts, was the Noise and Bustle that was made among us about Vomiting in Fevers, about a Year ago: I endeavoured to satisfy my self so as you may see, and had the Vanity to think there might be some as great Fools as I; if I be mistaken it is not the first time.*

*I have not been over nice in ranging the Particulars here contained; those who read the whole will see their Dependance, and for others I was not at the Pains to lay in.*

*The Language is that which most easily dropt from my Pen at first writing, the Roughness of some Terms of Art I could not avoid, and the Purity of the English Tongue is neither the growth of our Country, nor of my Occasions; if it be intelligible it is all (and perhaps some may say more than) I designed.*

*I neither expect nor desire any Reputation from these Papers, for I sufficiently know how few such things oblige. Besides I am dreadfully afraid few will read them, and not over many understand them, for want of the necessary Qualifications of a moderate Attention, and a smattering of the Mathematics. The first is absolutely necessary, but for the latter, they may even have a strong Faith, though, both for them and my self, I could wish it were joined with Knowledge.*

*As for Censure, I am in no great dread of it ; for I shall lie secure (because concealed) and see its Adversaries (if it have the Honour to provoke any) shoot at Rovers. If any shall take the Pains to confute what I have advanced he may do it very safely for his humble Servant ; if he bungle it, he will do me an honour, by shewing it is not such as every Body is able to disprove ; if he do it to Purpose, he will do me a Kindness, by freeing me from Errors. I design for the future to meddle no more with it, than if it had dropt from the Clouds.*

*In fine, all my present Concern is for the Bookseller ; if he be not a Loser, (which Misfortune would be the most effectual Confutation) it is indifferent to me, whether it perish by a particular, or the general Conflagration.*





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A N  
E S S A Y  
CONCERNING THE  
IMPROVEMENTS  
OF THE  
*Theory of Medicine.*

T H E R E are none of the Liberal Arts more necessary or useful to Mankind than *Medicine*; and yet, by what ill Fate I cannot tell, there is not one of them which is not brought nearer Perfection than it: The Institutions of most of the best are reckoned necessary Qualifications for a *Gentleman*; but few study *Medicine*, save those who design to live by the Practice thereof. How to account for this, is no easy matter, unless we say (what is true) that for the most part it has been hitherto so scurvily treated, the Grounds of its Theory, and consequently

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## 2      *Theory of* MEDICINE.

sequently of the Practice built thereon, made so precarious, absurd, and often contradictory, that Men (no otherwise obliged thereto) were loth to lay out their Time and Pains on such Uncertainties. They saw many Practitioners, rather *Empirics* than *Physicians*, who prescribed such Remedies, as they read or heard had been successful in Cases, which they imagined like that of their Patients ; but knew nothing either of the Cause of the Distemper, or of the Reason of the Cure.

IT is true indeed, it is so very hard to obtain any tolerable Knowledge of the History of Nature, and of the Springs of Life, of the Virtues of Medicines, and the Texture of the animal Body ; the Manner of the Operation of the former, and the Laws of the Motions of the latter, that this may be one very good Reason, why Medicine has not been farther advanced. Yet notwithstanding all these, had the genuine and true Method of obtaining these Things been constantly and vigorously pursued but half the Time of what has passed, since *Medicine* first came to be cultivated ; it had made another Appearance than it does at this Day. If four thousand Years ago, when Men saw the glorious Body of the Sun rise sometimes in one Place, and sometimes in another, and set with the like Variety : At one Season just peep up, and then down again ; at another stay a long Time with us ; in one Place never disappear, at another

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never be seen for a considerable Period ; and at a third, stay and go at equal Distances of Time : When they saw the Brightness of a Summer's Noon-tide, all of a sudden, turned into the palpable Darknefs of a Winter's Midnight, without knowing any Reason for the same : When they saw the Moon appear sometimes in one Figure, sometimes in another ; rise here to Day, there a few Days after ; and a short Time after this, no where at all ; at one Season all clear, the next Minute all over dark ; now stand, then go, now before the Sun, then behind him ; now near him, then far from him, with a thousand other Varieties : When they saw all the Changes, Vicissitudes, and various Positions of the Planets, the Uncertainties of the Tides, and the numberless Number and Order of the fixed Stars : I say, then, when they only saw, and knew nothing more about these, if any had said, that all these infinite Varieties might be reduced to Rule and Order, that we might come to understand the Laws of their Motions, and the Nature of their Orbits, their Positions, Appearances, and Distances from us, and one another ; that we might come to predict their Settings and Risings, their Stations and Retrogradations, their full and partial Appearances, and their compleat and incompleat Disappearances, and that too almost to the greatest Precision we are capable to distinguish or apprehend. But (which is the utmost Perfection



fection of these things) if any had said, we should at last come to understand the Reason and Cause of these various Motions and Appearances, he would have scarcely been believed. And yet we know all these things have come to pass in our Days; and that, only by pursuing a true Method, every one improving upon the Observation of his Predecessor, 'till all the *Phænomena* were compleatly gathered, and then applying the Science of Quantity, (*i. e.* Geometry and Numbers) to investigate their Orbits, their Distances, the Laws of their Motions, their Natures, and their Causes; by such Means as these, Men have brought *Astronomy* almost to the highest Pinnacle of Perfection. Now, if *Medicine* had been thus treated (as it ought to have been) but half the Time which has passed, since it came first to be cultivated; I can boldly affirm, if it had not been brought to Certainty and Demonstration; yet, it had been above the Contempt and Reproaches which are now daily thrown upon it; and had not been the common Theme of the lowest Pretenders to Satire and Wit.

WHATEVER be the Principle of Perception in human, or of Sensation in brute Animals; yet it is allowed by all Sects of *Philosophers* and *Physicians*, that all the Distempers and Disorders of the Body of both are owing to a Vitiation of the Quantity, Quality, or Motion of the

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the Fluids, or to a bad Disposition and Texture, a Distortion, Distention, Luxation, or Dilaceration of their Conduits, and the other solid Parts of their Bodies; and that Medicines operate by the Application and Mixture of their Juices, or by a Communication of their Virtues to these. And seeing all these are the Modifications and Qualities of material Beings, which have the Dimensions of Bodies, and are therefore *Quanta*; it necessarily follows, that the only Method of examining the Effects and Causes of these Qualities, is by applying to them the Doctrine of Quantity, *i. e.* Geometry and Numbers; and it is altogether unaccountable, how the World has not been sufficiently aware of this, 'till within these few Years.

THE Antients indeed have given us many noble Remedies for several Distempers; many sound Advices about the Management of a Patient, and for the Discovery of the Names (not the Natures) of most Diseases, by telling us what Antecedents, Consequents, and Concomitants were affixed to such a Distemper, which they called by such a Name. In a word, they have done tolerably as to the practical Part, though, after all, many of their Receipts and Remedies seem very little to us now: For such is the Intemperance, Indiscretion, and Lewdness (to which, either personal or transmitted, I would ascribe many of  
our



our Maladies) of our Days, that we are in compleat Possession of all their Diseases, heightened by as many Degrees of Malignity, as there are Years betwixt us and them; and in the mean Time we have begotten an infinite Variety of plaguy new ones, against which, most of their Remedies would have less Force, than the Children of our Age against the Giants of theirs. However, Practice was the only Part of Medicine they can be said to have any whit improved. For *Theory*: As their Philosophy was not tolerable, so their Anatomy was little better, and their Natural History worst of all; insomuch, that they were almost destitute of the necessary *Præcognita* thereto. It is true, they all required, in a Student of Medicine, a Knowledge in Geometry and Numbers; and thought it indispensably necessary to any one, who should offer to dispense a Drug, adjust a Composition, or give an Account of the Manner of the Operation of Medicaments; yea sometimes we have a few Hints of the Application of these in some Cases: Yet it cannot be denied, they made less Use of it than they might and should have done, to the great Detriment of Medicine, as it is a *Science*. An evident Instance of this is the Circulation of the Blood, which, if they had but very little considered the Laws of Motion, and the Elements of Geometry, they could not have been ignorant of, as certainly



tainly all that are not bigotted must acknowledge they were.

THOSE, betwixt the Antients and them of these two last Centuries, treated Medicine as all other Sciences were then used : They translated, commented, and borrowed from the Ancients, and one another ; made a great Potther about Words, and Tropes, and Metaphors ; but, for the most Part, left the Science in no better State than they found it. It is true, there have been some great Men in all Ages, who have managed their Provinces with Skill and Address : But it is certain, that Part of Medicine, we are now enquiring into, received but few Improvements in those Days.

AFTER the Time of the Restauration of Letters, *Medicine* advanced proportionally with other Sciences ; Anatomy was inquired into with good Success by some ; the History of Nature, Philosophy, and Chemistry, by others ; so that, e'er this Time, the theorick Part of *Medicine* had arrived to a considerable Perfection, had not these two last, misapplied, stepped in to hinder the same.

THE *Philosophic Physicians* were so fond of their Systems, that every medical Appearance must do them Homage : All was resolved into substantial Forms, Sympathies, and Antipathies, &c. or into subtile *Æther*, Congruities,



gruities, and Incongruities, &c. would they, nill'd they ; not considering that the first of these is a mere Metaphor, *i. e.* in the present Case, Words without a distinct Meaning ; and that the second is plain Nonsense, unless these things naturally follow from the determined Laws of Motion ; and, in a word, that all Natural Philosophy, unless supported by Geometry, is but a pleasant *Romance*.

THE *Chemical Physicians* were yet more wild to introduce their *Laboratories* into the Bodies of Animals ; and to expect the same Effects from our Vessels, as from their Retorts. Some of them have resolved the Causes of all Diseases into Acids, and therefore they must be cured by Alcalious Remedies : Others, by an opposite Extream, have resolved Diseases into these, and therefore they must be cured by those. They have made a great Noise with their Fermentations, Effervescences, and the like ; while, in the mean time, we are certain, that neither the one nor the other is in the right, and that the Heat of our Bodies is no ways able to produce the same Effect with their Furnaces ; neither are we able to mix three or four different Liquors in a fine Glass Tube, much less can we expect such Effects, as they ascribe to their Fermentations, from the much more slender Canals of animal Bodies. I shall not offer at a formal Confutation of these different *Ætiologists* ; the Matter has  
been



been done, or will be done, by much better Pens; but this in the general I may say, That allowing these Gentlemen all they crave, yet still all is Nonsense, unless they first shew their Systems and Chemical Effects to be necessary Corollaries from the known Laws of Motion, *i. e.* unless all their Philosophy, and Chemistry too, be first mechanically explained; which most of these Gentlemen do not pretend to.

*Gallileo*, *Torricelli*, and *Paschal*, the first by Water, the other by Mercury, and the third from the Effects of one and the same Experiment at different Heights, brought to light these three grand Properties of the Air; (that Fluid, which is so absolutely necessary, and so universally useful, both to the Being and Operations of Animals and Vegetables) to wit, its Elasticity, Gravity, and circumambient Pressure, which have served in great stead toward the mechanical Explication of the animal Oeconomy. *Snellius* first found out the true Measure of the Refractions of Light, which serves to explain the Phænomena of Vision: And several have shewn the Analogy betwixt the Motions of musical Organs, and their Effects on the ambient Fluid, and the Vibrations of a Pendulum, whereby the Diversities of Sound, and the Manner of Hearing, are explained.



*Des Cartes*, by a bold (not to say impious) Attempt, was the first (since *Prometheus* and *Democritus's* Days) who endeavoured to create an Animal, *Magnis tamen excidit ausis*. But to be just to him, he was no mean Person; for, not to speak of the Analytical and Geometrical Improvements, which are acknowledged to be his, (such are the Solution of Biquadratic *Æquations*, the Analytical Investigation of all *Loca*, the Expression of the Natures of Curves by *Æquations* which renders them so manageable; the Geometrical Construction of *Æquations* of all Degrees, the Determination of the Curves of Reflexion and Refraction (which had perfected Optical Machines as to the Theory, had not a wonderful Property of Light, since discovered, come cross to it) the Manner of the Investigation of which Three, the greatest Men of this or any other Age, have lately thought it worth their Pains to shew: But above all, the Invention of a Method of Tangents, which was unknown to the World before; (and how comprehensive the same Method is, *Hudde* and *L'Hospital* have shewn) I say, besides all these, it was he who first banished effectually the *Aristotelian* Jargon, and made Men reflect upon the natural Right they had to a Freedom of Thinking: And tho' for the most part he did substitute a bad System in its room, yet it was such an one, as made Men reflect more upon the Necessity of applying

Geometry



Geometry to Natural Philosophy ; but which is most for our present Purpose, he was the first who explained mechanically the Nature of Vision, and the Construction of the Eye : He has likewise given several considerable Hints towards the better Understanding of the Nature of Sound, how it acts on our Organs, and raises the several Passions, both in his other Works, and in his *Compendium* of Musick ; and tho' this last Treatise be unlicked and unshapen, and never designed for the Public, as himself says, yet it has some few uncommon Touches not unworthy its Author.

BUT all hitherto done was only pickering, or rather storming the Outworks of the *Theory of Medicine* ; the Fort was safe and entire, till the noble *Harvey* gave it a fatal Shock in the Discovery of the *Circulation* of the *Blood* ; a Discovery so wonderful, useful, and happy, that all Ages will admire and bless its Author ; a Discovery so conformable to the Rules of Mechanism, and the Laws of Motion, and so fitted to that Geometry, the wise Director of Nature uses in all his wonderful Works ; in a word, a Discovery, which has let in more Light into the *Theory of Medicine*, than almost all the former joined together.

ABOUT this Time, *Steno* endeavoured to give an Account of the true Structure of un-  
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compounded *Muscles*, and to explain mechanically the manner of their Operation: And tho' he was mistaken in both, yet by this Attempt, he reduced the Choices behind into a lesser Number, and increased Mens Desires to search into the true Mechanism of these Wonders of Nature. He likewise published a Treatise, *De Solido intra Solidum*, wherein, besides several useful things in Natural Philosophy, there are some which have been since happily applied to that Part of *Medicine* we are now enquiring into.

*Sanctorius* likewise, in his admirable Treatise of *Statical Medicine*, has obliged the World with many excellent Rules of Health, and many useful Observations of the Quantities and Proportions of the several natural *Evacuations*, and the Effects of the Suppressions of these, whereby Men are enabled to talk more distinctly, and not left to guess at random about such Things. It is to him, likewise, we owe the Invention of what is now called the *Thermometer*, whereby we are not only enabled to distinguish the several Degrees of Heat and Cold, to a much greater Exactness than formerly, by our bare Senses, but likewise to prognosticate something about the Changes of the Weather; but which is most of all, we are thereby enabled to understand something more than formerly, about the Cause



Cause of the unnatural Ascent of the nutritious Juices in Plants and Vegetables.

AT last came out that surprizing Piece of *Borelli's De Motu Animalium*, giving the true Mechanism of the external Motions of Animals, and forward Advances in that of the internal Motions: For him was reserved the great Honour of augmenting the Number of Sciences by one; one, the noblest and most admirable that ever human Wit invented! For, by a vast Skill Mechanicks, and a wonderful happy Subtilty of Genius, he not only invented, but, himself alone, almost perfected that Science; a piece of good Fortune, which seldom ever happened to one and the same Person. His first Part of the external Motions is perfectly charming, insomuch, that nothing fuller and more compleat can be desired on the Head. It is true, the most ingenious *John Bernoulli*, the worthy Professor of Mathematics at *Groningen*, (from a Property of Fluids, and a Method of Investigation, which was not known to *Borelli*) has given the Grounds of a much exacter Calculation of the Elevation of the *Pondera* from their given Resistances, and the Dilatations of the *Machinulæ* which constitute the distractile *Fibres* of the *Muscles*, than *Borelli's*, in the XCVIIIth Proposition of his first Part; and has likewise drawn many ingenious Corollaries from that Speculation, determining the Curve



these *Machinulæ* would describe, by a Section through their Direction, and the Proportions of the *Liquidum Nervorum*, or, as he calls it, the *Aura motiva* to the *Pondera elevanda*. But it must be granted, *Borelli* has made the best use of all the Geometry known in his Days of any who went before him. In his second Part, he has many admirable Propositions for calculating the Force of the Heart, and the *Impetus* which the Arterial Blood receives from it, the determining the Necessity of its given Structure, the Manner, Nature, and Use of Respiration; besides many useful Hints for the Discovery of the Motions and Natures of the Fluids of the Body. But it must be confessed, this Part is not near so compleat as the other: Some of the Motions of the Fluids, and the Natures of the Canals, were things not manageable by his Geometry; and he neither had so perfect a Skill in the *Practical* Part of *Medicine*, nor was Anatomy so fully discovered as now to compleat that Part.

HIS noble Disciple *Bellini* has taken up the Science where he left it. He, by an exact Skill in Anatomy, a perfect Knowledge in the *Practical* Part of *Medicine*, a nice and true Observation of the less common Effects of Nature, and a good Understanding in the Mechanical Philosophy, has much improved that Part of the internal Motions of Animals: He has nicely distinguished the Natures and Differences



Differences of Urines and Pulses ; He has justly explained the Effects of Blood-letting in several ingenious Propositions : He has handled the general Causes and Distinctions of Fevers ; the Manner of the Operation of some Medicaments, the Diseases of the Head and Breast, after a Manner no less uncommon than genuine ; whereby he has put a quite new, but natural Face on Medicine, and reduced it pretty near to a Science, which was before but a Trade. There are several useful and ingenious Propositions in his late Book, about the Motion of the Heart, the Blood, and the other Fluids ; the Manner how to discover the Tendency of the Fluid from the Figure of the Canal given, a Confutation of the *Chemical* Fermentations in Secretion, and an Illustration of his former Treatise about Blood-letting. But in my Opinion, the noblest and most admirably useful Part of his whole Works, is that about the true Structure of the *Glands*, and his Hints about the Laws and Manner of Secretion. It is a great Pity, that he has not, or will not explain this more fully himself ; for I reckon it, and the *Circulation* of the Blood, to be the Key, whereby the *Geometria recondita* will have admittance into, and let in an *Ocean* of Light to these dark internal Regions.

OUR Countryman, Doctor *Pitcairne*, has admirably illustrated this Part, so far as the



Labour of constant Teaching in one Place or the Hurry of a toilsome Practice in another could allow ; He has demonstrated the genuine Nature of the *Circulation* of the Blood by shewing the necessity of the Continuity of the Veins to the Arteries : He has shewn the Mechanical Structure of the Lungs, and thence the necessary Effects of Respiration ; He has assigned the Organs their Force and Nature and the true manner of Digestion, and freed us from the Fury of a corroding *Menstruum*. He has demonstrated the necessity of Obstructions rather happening in the Arteries than in the Nerves, and in the Nerves rather than Veins ; and how these Obstructions are produced : He has demonstrated the Evacuation proper in Fevers, and the Cause and Nature of the Diseases of the Eye : He has banished effectually the plausible Congruity of Pores in Secretion, the ridiculous Cant of Acids and Alkali's, and the whimsical Fancy of Ferments ; besides many other noble Hints, which his manly *Laconic* Eloquence has left undertailed to the Sagacity of the attentive Reader.

BESIDES all these, several Gentlemen of the *Royal Society* at *London*, (which did cast the first Copy to the rest of *Europe*) and of the *Royal Academy* of Sciences in *France*, and of several other Philosophic Societies, have discovered many useful Theorems, and made many noble Experiments, toward the Ill-

lustration



illustration of the Mechanical *Theory* of *Medicine*, which are never sufficiently to be admired or commended.

THESE are the Men, and this is a short Account of what they have done, so far as I know or remember, toward the *Theoretic* Part (at least, toward what I think deserves that Name) of Medicine. A great many Noble Things this way they have done, and many considerable Difficulties they have overcome: But it cannot be denied, there still remains an ample Field for the Industry of the present and future Ages. It would suppose that one knoweth (which God knows I do not) all that has been hitherto discovered, and that he were almost able to supply the Remainder, to give a particular Account of what is wanting in this Part: However, I shall venture to give my Opinion of some things which are evidently deficient.

I. THOUGH I think the greater, and more easily conspicuous Organs and Parts of Animals and Vegetables, be entirely discovered by the Industry of ingenious Anatomists of our *Island*, and those of other Countries; yet I think we have not, as yet, so compleat an Inspection into the more minute and less obvious Parts of these, which must be absolutely necessary toward a compleat Theory of Medicine: We have not, as yet, traced the Continuation of  
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the Arteries, Veins, and Nerves, so far as they go, not so far as I hope they may be traced: We have not, as yet, a perfect Discovery of the Texture of the Brain in all its Parts: We have not, as yet, been able to evolve the compounding Vessels of any more Glands, than the Intestines and *Testiculi*: We want the true Texture of the *Liver*, *Pancreas*, *Spleen*, *Kidnies*, and all the other Conglobulous and Conglomerate Glands: We have not discovered the Texture and Range of the Vessels under the *Cuticula*. But, which is worst of all, we have not, as yet, determined the true Situation, nor Position, the Windings and Branchings, the Angles they make with one another, or the Curves they describe, of most of the known and visible Canals, which might be easily done. The Anatomy of Human Bodies is as yet very imperfect, and our *Comparative Anatomy* is quite lame: Besides, a Thousand other Things which might be here added, which are necessary to a true Theory; for unless our Theories and Observations confirm one another, they will be still little more than the most probable Conjectures. The Performances of *Malpighius*, *Dr Grew*, *Lewenhoeck*, and others, as to this deficient Part, are very well; but still there are here many things desirable, which I hope are reserved for some of these, or others, endued with a dextrous Hand, a quick Sight and Observation; assisted with  
fine



fine Microscopes, and a good Skill, both in the common and more abstruse Geometry.

II. WE evidently want a compleat *History* of *Nature*, *i. e.* the Names and Natures, the Distinctions and Properties, of the Animal, Vegetable, and Mineral Kingdoms. It is true much has been done already, and still is a doing, this way, by the noble Members of Philosophic Societies, and other private Persons; yet still very much is wanting. And till that Part of it, which is necessary in Medicine (and how far that may extend none can tell) be perfected, we cannot expect a compleat Theory thereof: For all know how useful a perfect Skill in the Nature and Virtues of the Remedies, is, to the full understanding the Disease, and the manner of its Cure.

III. WE want a compleat System of Mechanic Philosophy, *i. e.* an Account of all the visible Effects of Nature upon Geometric Principles; for it is not Systems, as they are an Explication of all the Effects of Nature from the same Principles, which are so justly ridiculed, but Systems, as they are ungeometrical. It is true indeed, all the great, visible, constant and uniform *Phænomena* of Nature, have been attempted by the eminent Mathematicians of this and the last Age, but accounted for, from rigorous Geometry, by that stupendiously Great Man, Sir *Isaac Newton*, *Quem*  
*secula*



*secula nulla tacebunt*: He has not only given the true Causes of these *Grand Appearances*, the Laws of Motion, and the Nature of Fluids, the Nature of Light and Sound, the Manner and Rules of their Propagation; in a Word, all the general Mathematical Principles, whereby to examine the Pretensions of different Systems, and many new surprizing Problems and Theorems in the speculative Part of Geometry; but he has likewise discovered the true Principle of all the Effects of Nature, to wit, Attraction, or Gravitation: But, which is most of all, to him we owe the only Key whereby the Secrets of Nature are unlocked, to wit, the general Way of managing *Æquations*, the Methods of *Infinite Series's*, and of *Fluxions*, direct and inverse; Examples of which, his whole *Principia* are. This is that which will bring *Analytics*, *Geometry*, *Natural Philosophy*, and the *Theory of Medicine*, to their utmost Perfection, if ever they get thither: By these we are able to contract all the Mysteries of the Ancient and Modern Geometers into the room of a few Lines, and disclose them with a few Scrapes of our Pens; of which, when People see the Conclusions without knowing these Methods, they look like conjuring, or something above the Capacity of Men. Yet, after all, these Methods have not as yet been applied to the lesser, less obvious, less constant, and less uniform Effects of Nature, of which we are principally speaking here,



here, and which are so absolutely necessary to a true Theory of Medicine: And though I am persuaded, that from the same Principles the grand Appearances of Nature have been accounted for, these more minute ones may be so too; yet it is what has not been actually done, and without which we shall be still straitned in our Theories. We want to know the Mechanical Account of Chemical Operations, and Preparations of several sorts; which is a vast Defect: We want to know something more about the Nature of Fluidity, and what it is makes up the many Varieties and Differences of Fluids from one another; the Figures of their constituent Particles, and a compleat Collection of the Laws of their Motions: We want to know the true and adequate Nature and Cause of Heat and Cold, and the Reason of their odd Effects: We know not the Figures of the Particles of Bodies which produce such Varieties of Tastes: We want to know the Figures of the Particles of Bodies, which naturally form themselves into such and such Shapes, after the manner *Huygens* has analysed Island Chrystal; this would be of mighty use toward the full understanding of the Natures of all Saline Bodies, which generally form themselves into determined Figures: We do not, as yet, understand the Principles of *Individuation* (if I may so call it) of one kind of Body from another; Why some have such Grains, Colours, and Shapes, others different:



different: We know not the true Nature and Cause of *Elasticity*, which is of so great Extent in the Animal Oeconomy: We want to know a great deal more about Light and Colours, Opacity and Transparency, though we hope to receive Satisfaction therein shortly, from that great Person, who has so dearly obliged the World already. These, and a Thousand other Things, we want, which he only can enumerate, who could supply them: And though we have many and noble Hints in most of these, from *Borelli*, Sir *Isaac Newton*, and some other Mathematicians, yet we have not so perfect a Knowledge of them as might be desired, and, as I hope, may some Day or other be obtained.

IV. Lastly, We want a *Principia Medicinæ Theoreticæ Mathematicæ*: Albeit the Theory of Medicine and Natural Philosophy be nearly allied, and though the lately mentioned great Man has almost compleated the latter, yet he did it not with that View to be mainly subservient to the former: And though *Borelli*, in his excellent Book, *De Vi Percussionis & de Motu Naturæ à Gravitate factis*, has demonstrated several things useful to that Purpose, yet he concerned himself mainly but with those things which he thought necessary to the understanding of his Book, *De Motu Animalium*: So that, notwithstanding both these, we have not such a Book as I reckon this should



should be. Such a Book (among many other things, which I am not capable to enumerate) should at least contain these things: 1. It should contain the true Nature of Fluidity, wherein it consists, and what it is that makes one Fluid differ from another, the Figures of their constituent Particles, and why there are Solids of such and such determined Shapes, naturally generated in each particular Fluid; the general Laws of the Motions of all Fluids, and the particular ones of each different Kind, whether homogeneous and uniform, or a Mixture of several different Kinds. 2. It should contain the Nature and Cause of Elasticity, and the Figure of the constituent Particles of Elastic Bodies, and the Laws of the Percussions and Reflections of such; the Curve, into which Elastic Bodies naturally form themselves, when bended, if they observe one constant Law, *i. e.* if the Tension be always proportional to the bending Force; or the several Curves they must describe; if different Elastic Bodies observe different Proportions, (as *James Bernoulli* has done) which would be infinitely useful in the Theory of Medicine. 3. Since it is certain now, that Glands are nothing but a Complication and Circumvolution of the Arteries into Curves of such and such Natures and Numbers, or into *Plicæ*, whose Turnings are Curves, or make right-lined Angles of such and such Quantities: Such a Book ought to determine the Effects arising



arising in the Fluids, as to the Acceleration or Retardation of their Motion, their Viscidity or Fluidity, the Comminution or Augmentation of that of their constituent Particles, when moved in Canals turned and complicated, into all possible curve or right-lined Figures; and what Effects would arise in the curved Canals themselves, as to their Elasticity or Distractility in being turned into such and such Curves. I imagine it is some such thing as this, which *Gulielmini* promises in the Preface of his Treatise, *De Aquarum fluentium mensura*; For we know the Laws of the Motions of Fluids in direct Canals already. This would be a Work of vast Labour, but of noble Use; and we know not but general Methods might be fallen upon to alleviate the Labour of the Calculations. Sir *Isaac Newton* has given one Theorem in two Lines, which, if rightly managed, will give the Quadratures, Rectifications, Surfaces, Solidities, Centers of Gravity and Percussion, or Oscillation of all imaginable Curves and Solids whose Natures can be expressed by any Analytical  $\text{\AA}$ Equation whatsoever. I know of something like the same done for all Curves and Solids, whose Natures are expressed by Transcendent or Exponential  $\text{\AA}$ Equations, *i. e.* such as he calls *Geometricè Irrationales*: And perhaps both these last may be compounded into one, and consequently comprehend the first likewise. Now, if such general Methods were



were fallen upon, for these which we are speaking of, it would save a great deal of Calculation, Reading, and Writing; and why it may not, I see no Reason to doubt. 4. It ought to contain a Calculation or Determination of what Effects the Fluids would have upon one another, and upon Canals formed into such Curves, upon an Augmentation or Diminution of their Quantities, an Acceleration or Retardation of their Motions, the Increase or Diminution of their specific Gravities, or of the Bulk and Figure of their constituent Particles; or the Alteration of their Fluidities, or Viscidities. 5. It should contain what Effects solid Particles of all Figures, Sizes, and different Gravities, mixt with Fluids of all kinds, would have upon the Fluids themselves, or upon the distractile Canals of such and such Figures. 6. Lastly, it ought to contain the final Causes, and the Mechanical Necessity of the given Figures of the more solid Parts of the Body: Why some Glands are Conglobous, others Conglomerate, as they are called; Why the Testicles resemble a Spheroid, generated by the Circumvolution of the Semi-ellipsis about its longest Axis; and the Heart, one generated by the Circumvolution of a Semi-ellipsis about a Diameter oblique to its longest Axis, or at an Angle of 45 Degrees with the same. Why the Muscles, some of them are of one Figure and Texture,



ture, some of them of another ; some situated near the Part to be moved, others at a greater Distance from it. Now, though many of these things, here mentioned, are to be found already accounted for, and demonstrated in the Writings of the Geometers of this Age: Yet one, who professedly designed to treat of these things for the Benefit of Medicine, should either transcribe them out of these, or demonstrate them a-new after his own Method, that we might have all that belongs to this Subject together in one Book.

BUT after all, perhaps, it may be said, such a Chimerical Piece as this, toward which there are required so many hard (not to say impossible) things, will never be written by all the Wit of Men. To this, I answer, That there are very great Advances towards such a Piece already made, and if a few ingenious Men, endowed with a perfect skill in the Abstract Geometry, and the new Methods of Investigation, should but manage this Province after the manner we formerly shewed Astronomy had been treated, each improving the Discoveries of the other, the one beginning where the other had left off; I doubt not, but these I have mentioned, and harder things too, might be brought to pass: And if once such a Book as this was finished, and the other necessary perquisites searched into, Medicine in  
a short



a short time might be brought to the immediate Confines of Demonstration.

THERE are two things, which would mightily conduce towards the perfecting such a Work as this of the *Principia Medicinæ Mathematica*. The first is, the publishing something concerning the *Inverse Method of Fluxions*, or as the *French* call it, *La Methode de Calcul integrant*; which might contain the Application thereof to all the intricate Problems of Geometry, and give general Canons for the Solution of all such, and likewise general Precepts for the Application of the same to Mechanic and Natural Philosophy, with the Illustration of them by many particular Examples from Sir *Isaac Newton's Principia*, and the noble Problems solved within these twelve Years, and published in the *Philosophical Transactions*, *Acta Lipsiæ*, and *Journals des Sçavans*. For though a Man with a great deal of Pains may gather the Materials of such a Book, from Scraps here and there, yet they are few who have so much leisure, or, if they have, will give themselves the trouble; or, if they could do both, have the Convenience of searching into so many different Books, to gather up what is necessary to furnish them with a tolerable Knowledge of this wonderful Method: And therefore it would be of great Use to the World, and to the Improvement of

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Learning



Learning in general, that a Book containing, at least, all that is already published on this Head were compiled and set in a clear Order. It is true, the noble *Leibniz* has promised such a Book as this, but I am afraid his great Employment will deprive us too long of that Advantage: Besides, I doubt he will not condescend to the Capacity of the lower Rank of Geometers, for which such a Book should be principally designed. *Carre* indeed has given the first Rudiments of such a Work, but he is so far from giving an Account of all that is published this way already, that I am afraid he has not understood them himself, his Performances on that Head being so very low. A second Thing, which would very much conduce toward the Work we were speaking of, is, that the great Geometers of this present Age would be pleased to publish those many noble Secrets of Geometry and Philosophy, which, to the great Detriment of Learning, they think fit to conceal: What Reasons they have for doing so, they know best themselves, but I am sure it would be a greater Honour done to themselves, and a greater Advantage to the Age they live in, and in particular to the Mathematics, to communicate to the public such things, as they know have not as yet been made common, than to keep up the Method, now in Vogue among some, of proposing hard Problems, (which are at least supposed, known by the Proposers,) to employ  
the



the Time of others, which might be laid out on Things as yet unknown : This would put an end to the Contentions about the Honour of Inventions, and prevent the melancholy Disappointment arising from finding out excellent Things, and yet not to be reckoned the Inventors of them. There could be no greater Encouragement for an ingenious Man, than to be sure he should not bestow his Time in vain, if he were successful in his Design ; that is, to be sure he is not already prevented.

THUS I have frankly given my hasty Thoughts about Things of very great Importance : But I hope the candid Reader will more easily pardon the many Escapes of this rude Draught of an Essay, for these Reasons. First, that it was written in a Place destitute of all common Assistances, and that I could be at no ease till it was done, the Bookseller pressing to have it without any Delay : And in the next Place, that if ever I shall be betrayed into publishing any thing again, it should be on a Subject less obnoxious to wrangle, and where there is a surer Guide than *Imagination*. For to deal freely with the Reader, it was out of mere Indignation that I put Pen to Paper on this Subject, having seen it so unskilfully managed by two of our own Physicians here in Town, who some time ago played at *Logger-heads*, about Vomitting in Fevers. I owe them thanks, for the many good Words,

C 2

and



and a few good Offices they have ineffectually endeavoured to do for him whom they suspected to be the Author (how far their Kindness would have extended itself toward him, who is the Author, indeed had they known him, we may easily guess); however, all that I shall say of them, is, that the one (that Enemy to all Schemes, Figures, Sense, and Demonstrations) had a bad Cause, and defended it most wretchedly : And that the other, having imitated the Practice of better Physicians was not so happy as to imitate their Reasoning, but spoiled a good Cause by bad Arguments.





A N E W

T H E O R Y

O F

*Acute and Slow Continued*

F E V E R S.







A N E W

T H E O R Y

O F

*Continual FEVERS.*

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P O S T U L A T A.

I. **T**H A T the whole Body is nothing but a Congeries of Canals, the greatest (at least a considerable) Part of which is *Glands*, properly so called, designed for the Separation of some Fluid.

THIS is evident, when any Part of the Body is swelled, so that the inconspicuous ones become visible; and has been clearly demonstrated by *Malpighius*, *Leuwenhoeck* and others.

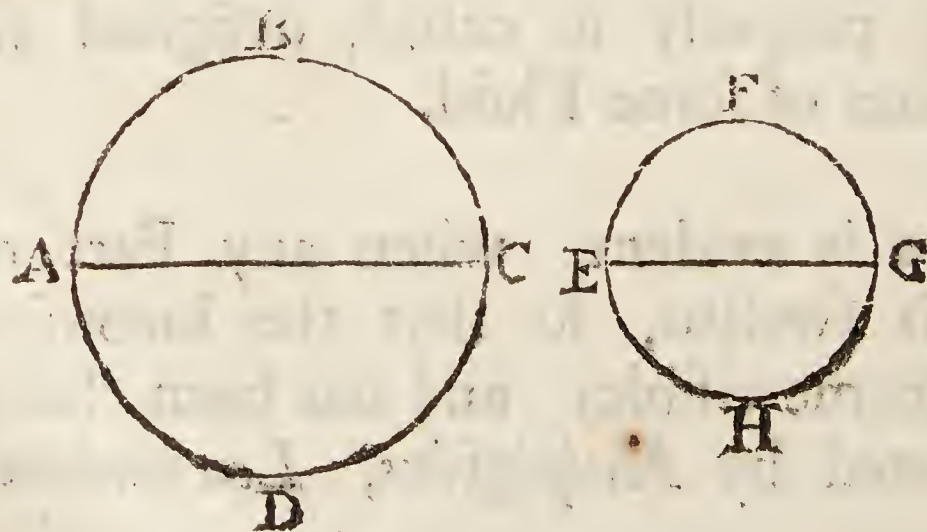


2. THAT when a Machine is disordered, if we should see it righted by adjusting such a particular Part, we might without Scruple affirm, that it was some Injury done to that Part, which had disordered the Machine ; especially, if after the whole was taken to Pieces, we should find them all found, save that particular one.

THUS, if we should see a Watchmaker, by adjusting only the Ballance of a Watch, make it go right ; we might say the Distortion of the Axis thereof had occasioned it's going wrong ; especially, if all the other Parts be found as they should be.

*L E M M A I.*

LET there be a greater Distractile Cylindrical Canal, whose Orifice is A B C D, through which a given Quantity of Liquor passes in a given time ; and a lesser one E F G H,



through



through which a proportionable Quantity of the same Liquor passes with the same Celerity as in the former: Let now the greater  $A B C D$  be increased or diminished by the lesser  $E F G H$ , so as that in the increased or diminished Cylindrical Canals, the same Quantities only pass, which passed in the same Time in the first supposed Canal,  $A B C D$ : To find the Quantity of the same Fluid, which will distract (and produce the other Effects of increasing the Quantity of the passing Fluid, and consequently its Celerity) the Canal (by increasing its Diameter) first supposed,  $A B C D$ , after the same Manner, only that the increased ( $A B C D + E F G H$ ) or diminished ( $A B C D - E F G H$ ) Canals are now distracted.

LET the Quantity which in the first Supposition passes through the Canal  $A B C D$  be called  $a$ , and the Quantity which passes through the Canal  $E F G H$  be called  $b$ : Since in the first Supposition the Celerities are the same in both, their Orifices will be as  $a$  and  $b$  respectively. Likewise the increased and diminished Canals (seeing their Altitude is supposed the same) will be as their Orifices  $a + b$ , and  $a - b$ ; and the Quantities passing through them in the same time, with the same Celerity, would be likewise as  $a + b$  and  $a - b$ : But (in the second Supposition) the same Quantity is supposed to pass in the increased Canal ( $a + b$ ) and diminished one ( $a - b$ ) which passed



passed in the first supposed Canal A B C D, or  $a$ ; therefore now the Quantities passing through the Canals, increased or diminished, will be as  $a$ : wherefore, as  $a \pm b$ , (the Quantity passing through the increased or diminished Canals in the first Supposition) is to  $a$ ; (the Quantity passing through them in the second Supposition) so is  $b$ , (the Quantity passing through the lesser Canal E F G H, in the first

Supposition) to  $\frac{a b}{a \pm b}$ , the Proportional Quanti-

ty which passes through and will distract the lesser Canal E F G H, after the same Manner that the increased or diminished Canals are distracted in the second Position. Adding or subtracting this Quantity from  $a$ , (which is as the Quantity passing through, or distracting the increased or diminished Canals) the Sum

or Difference  $a \pm \frac{a b}{a \pm b} = \frac{a^2}{a \pm b}$  will be as

the Quantity which will distract the first supposed Canal A B C D after the same manner, &c. q. i. e.

### S C H O L I U M.

**T**H E whole Canals of the Body, (save the Intestines and Lacteals) may be considered as a concave Cylinder, whose Base is the Orifice of the Aorta at its exit from the Heart; and whose Length is a mean Arithmetic



metic Proportional betwixt the longest and shortest Artery (I mean the whole Length of the Artery till it degenerate into a Vein; for the Length of the Veins are of no Consideration here) it being their splitting into Branches, which makes them not Cylindrical. Now, by *Postul.* 1. the Vessels which make up the *Glands* may have any Proportion of Minority to the whole of the Canals; supposing then an Obstruction or Dilatation of the *Glandular* Vessels, it is evident the foresaid concave Cylinder will be thereby diminished or increased in any given Proportion: Suppose, *e. g.* the Diameter of the Cylinder so obstructed is to that of the whole, as 1 is to the  $\sqrt{2}$ ; their Orifices will be as 1 to 2. Suppose again, there are twenty Pounds of Blood in a Man, seeing at the Beginning of the Arterial Vessels, (which constitute the Glands) the Velocity is near the same, as proceeding from the same Cause, the Compression of the Heart: Therefore divide 20 into two Parts, which may be (in this Case) as 1 is to 2; (which is done by this general Rule  $x = \frac{m d}{m + n}$ ,  $y = \frac{n d}{m + n}$  putting  $d$  for the 20 Pounds,  $x$  for the greater, and  $y$  for the lesser proportional Part,  $m$  to  $n$  their *Ratio*) the Parts will be here  $6\frac{2}{3}$ , and  $13\frac{1}{3}$ ; which are the proportional Parts of 20 Pounds of Blood, which would naturally pass in the obstructed Canal, and in the Remainder thereof, which is passable. But if all the 20 Pounds must



must now pass in the passable Canals, then it will be distracted as much as if the whole Canals were passable; but that 30 Pounds of Blood were forced through it in the same time by the preceding Lemma. For in this Case  $a = 20$ ,  $b = 6\frac{2}{3}$ ,  $a - b = 13\frac{1}{3}$ ; and

therefore  $\frac{a a}{a - b} = 30$ . If the Orifices were as

1 to 3, then  $b = 5$ ,  $a - b = 15$  and  $\frac{a a}{a - b} = 26\frac{2}{3}$  this supposing an Obstruction. If there be a Dilatation supposed in the same Propor-

tions, then  $\frac{a a}{a + b}$  will be in the first Case 15,

in the second 16. The same may be applied to the *Liquidum Nervorum*, which passes in the Nervous Canals: For the *Gland* consists of a complicated *Nerve* as well as *Artery*, and in an Obstruction, or Dilatation of the same, both *Artery* and *Nerve* are supposed to be obstructed or dilated.

THE Design of all this is to shew, that in an Obstruction or Dilatation of the Vessels, it is the same Thing as if the Liquors therein contained were augmented or diminished in a certain Proportion; as in the Case of the Blood-Vessels, supposing 20 Pounds of Blood, (which is the ordinary Quantity) in a Man, and supposing one half of the whole (by an Obstruction in any Place of the said) Vessels were rendered



dered impassable, it is the same thing *quam proximè*, as if the whole Blood-vessels were passable; but that one half more of Blood were forced through them in the same time, in which the 20 Pounds passed. Of the same Nature is.

## L E M M A 2.

**T**HE Blood being so corrupted, that the Strength is impaired or increased, it is the same thing as if it were in its natural State, but that the Quantity thereof were diminished or increased in such a Proportion as is necessary for producing this Increase or Decrease of Strength.

THIS is the 49<sup>th</sup> Prop. of *Bellini's* Book *de Motu Cordis*, &c. and its Converse: The Proposition it self is there demonstrated, and its Converse may be demonstrated after the same Manner exactly.

WHAT is here said of increasing or diminishing the Strength, is likewise true of all the necessary Effects of lessening or increasing the Quantity of Blood. These things premised, I come to

T H E



## T H E

*General Proposition.*

**T**H E general and most effectual Cause of all Fevers, is the Obstruction or Dilatation of (the complicated *Nerve* and *Artery*, the *excretory Duct* and *conservatory* one, or rather all these; which, as shall be afterward shewn, make up) the *Glands*, and they receive their Denomination, as these or those *Glands* are more or less obstructed or dilated.

OTHER Things may concur, but these are the most powerful Causes.

IT were a Work of more Time and Pains than I can at present bestow, to apply this Proposition to all particular Kinds of *Fevers*; though I am sufficiently satisfied it will account for all. I shall here only (as an Earnest of the rest) shew how to apply it to *Continual Fevers*, and therefore contract the General into

T H E



## T H E

*Particular Proposition.*

**T**H E most effectual Cause of continual *Fevers*, is an Obstruction of the *Glands*, which will necessarily augment the Quantity of the Blood and *Liquidum Nervorum*, in the passable Canals, and perhaps (by the Stagnation of the Fluids contained in these) so vitiate their Nature, as that they may be reckoned to concur as a partial Cause of these *Fevers*: But I rely most on the first, to wit, the Augmentation of these Fluids. For a Demonstration of this, I shall first shew, how it accounts for all the Appearances of such *Fevers*, and then subjoin several Arguments to confirm the same.

SUPPOSING the *Glands* obstructed; the Quantity of the Blood in the *Arteries*, and the *Liquidum Nervorum* in the *Nerves*, may thereby be supposed augmented in any given Proportion of Minority to the whole Mass of these Liquors, *per Lemma 1.* and its *Scholium*. Wherefore it will hence follow,



§. 1. THAT the Pulses must be stronger and more frequent than ordinary, upon these Accounts. 1. Seeing there is a greater Quantity (than ordinary) of Blood in the *Arteries*, the Lateral Preffion will be stronger; and seeing the *Arteries* are distractile, they will be driven outward with greater Force, and make a stronger *Ictus* upon any thing applied to them. 2. Seeing the Quantity of the Blood is augmented, *i. e.* the Quantity of the Matter whence the *Liquidum Nervorum* is generated, there must be a greater Plenty thereof (*per poster. part. Lemm. 2.*) generated, and consequently it will flow more plentifully and more quickly into the Heart, and make it contract oftner and more violently. 3. By the Obstruction of the *Glands*, the Influence of of the *Liquidum Nervorum* thereinto is likewise obstructed; and therefore, *per Lemm. 1.* there will be a greater Quantity thereof left to flow in the passable *Nerves*, and it must flow *qua data porta.* 4. Lastly, The *Arteries* on every Side, running upon and touching the *Medullar Substance* and *Fibres* of the Brain, will (they being more than ordinarily distended) press them more than ordinarily, and make a more powerful and plentiful Derivation of the *Liquidum Nervorum* into the Places whither it can flow.

§. 2. FROM the same Cause the Inequality or Interruption of the Pulses is evident: For  
if



if the foresaid Pressions upon the *Nervous Fibres* of the *Brain* be so strong, that it either partly or *totally* occludes the Passage of the *Liquidum Nervorum*; there must be a Stop in the Derivation, till there be such a Quantity thereof collected, as shall be sufficient to over-power the *Impedimentum* occasioned by this Pression, and so make an Inequality or Stop in the Contraction of the Heart. Moreover, when the Blood flows in such Plenty, and with such Violence from the *Auricles* into the *Ventricles* of the Heart, it may force its way before the *Ventricle* be entirely contracted, and thereby cause an Irregularity in the Pulse. Add to these, what may proceed from the Thickness of the Blood (it being contracted into a less Space) and Evaporation of its Humidity. All these, either singly or compounded, will account for the Irregularities of the Pulses, which have hitherto been observed.

§. 3. GREAT Pains in the Head must ensue from the violent Distractions of the tender Vessels of the *Brain*, and from the the great Pressure of the extended *Arteries*, upon the *Fibres* and *Membranes* thereof, all the Canals of every kind being swelled with their respective Liquors; and that being the most sensible Place.



§. 4. A violent and burning Heat must be felt upon these Accounts, 1. Because there is a greater Quantity than ordinary running in the passable Canals, there must be a greater Motion than ordinary, and consequently a greater Heat. 2. Merely upon the Account of the increased Quantity, (without considering the thereby produced greater Velocity) there must be felt a greater Heat. For supposing the Heat in each single Particle to be the same as before; yet since the Particles are more numerous in the same Place, the Heat must be greater there too: As in Rays contracted by a *concave Speculum*. 3. The *Glands* being obstructed, *i. e.* the Passages of Perspiration, the natural Heat must thereby be kept in, and consequently the whole augmented *per Lem.* 1. Hence proceeds our unquenchable Thirst; the Humidity (*i. e.* the thinnest Parts) being more ready to evaporate (since now the ordinary Passages are obstructed) the rest must be proportionally dryer.

§. 5. THE Difficulty and Frequency of Respiration, and the Violence of Expiration, is hence easily accounted for: The Quantity of Blood being augmented, there must be a proportional greater Quantity thereof be derived into the *Arteries* of the Lungs; and since every one of the little Ve-

ficles



ficles of the *Bronchi* lie betwixt two *Arteries* thus inflated, it will be harder to explicate these *Vesicles*; and therefore one in such a State will naturally with all his Force endeavour to suck in the Air, which will be forced out again, both by these inflated *Arteries*, and by the Force of the *Muscles* of the *Breast*, *Diaphragm*, and *Lungs*; which is vastly augmented, both by the greater Quantity of Blood, and of the *Liquidum Nervorum*, and its more plentiful Derivation; as has been shewn, in §. 1. about the Frequency and Strength of the Pulses.

§. 6. THE Tongue is rough and discoloured, because, by the violent Motion of the Blood, and the Obstruction of the common Passages, the Humidity is evaporated, and the extraordinary Heat stiffens the *Fibres* thereof. For it is evident, that only Heat and Dryness discolour the Tongue. *Vide* §. 4.

§. 7. WANT of Sleep must follow both: Because there is such plenty of Blood, and consequently of the *Liquidum Nervorum*, (as is shewn, §. 1.) that there is no need of Sleep to generate more, which is one principal Use thereof: And because of divers Disorders of the Head (accounted for §. 3.) which will not allow that Tranquillity which



is necessary to bring it on ; but most of all, because (by the plenty of the *Liquidum Nervorum*) all the *Muscles* both involuntary and voluntary (especially those who want *Antagonists*) are in continual violent Motions, which must necessarily hinder Sleep.

§. 8. RAVINGS proceed from the Disorders in the Head, accounted for §. 3. The *Nerves* being distracted by the abundance of their Liquor, the Heat and Dryness of their Parts, cannot perform these Reciprocations which are necessary in sound Persons.

§. 9. THE clear and flame-coloured Urine proceeds from the Velocity of the Blood, which separates thereby only the thinnest of the mixt Fluid ; as shall be shewn when we come to speak about Secretion.

§. 10. THE vast increase of Strength in Persons labouring under high Fevers, is evident from *Lemm. 2.*

§. 11. LASTLY, The Ceasing and Dissolution of Fevers by Purging, Sweating, Vomitting, and Abscesses, is wonderfully accounted for from this *Theory*. For if they go off by the Strength of Nature, then, seeing the greater Quantity and Velocity of  
the



the Blood produce a greater *Momentum*, by the frequent Concussions and Force of this, the Obstructions are shattered and washed away till the last Strokes carry away all together; and thereby go off in these or those, according as these or those *Glands* were most obstructed. This will be better understood, when we come to speak of *Mercurial Medicines*: If by the Assistance of Medicines; then the Medicines must be such as are most proper for removing these Obstructions, as shall be afterwards shewn.

1. THUS, I think, I have accounted for all the Appearances of *Continual Fevers*; which I reckon one considerable Argument for our *Theory*.

2. ALL we see done in the Dissolution or Ceasing of such *Fevers*, is the opening the *Glands*, the driving out the stagnated Fluids therein contained, which *per Postul. 2.* is another Argument. And indeed one would hardly keep himself from thinking, that if the removing these Obstructions removed the Disease, then the putting them caused it: *Quo posito ponitur, & quo sublato tollitur.*

3. ALL that is observable upon opening Persons cut off by *Fevers*, is (the rest being sound and entire) an extraordinary Swelling



and Lividity in the internal *Glands*; particularly of the *Lungs*, the *Liver*, the *Spleen*, and the *Mesentery*; as has been observed by *Borelli* and others. *Vide Borelli de Motu Animal.* Part 2. Prop. 227. This is one ocular *Demonstration* of our *Theory*; and if the other *Glands* were as conspicuous, I doubt not we should see the same in them.

4. A fourth Argument for our *Theory* is from what Dr *Pitcairne* has demonstrated in his *Treatise* of the *Cure* of *Fevers*: For since in *Fevers* the *Glands* are obstructed, *i. e.* the Conduits of insensible Perspiration, then by removing this Obstruction, *i. e.* by increasing the insensible Perspiration, *Fevers* will be more probably cured, than by increasing all the sensible Evacuations: And that in the Proportion the Number of the *Glands* of the whole Body has to the Number of the *Glands* of the *primæ viæ*, or as the whole outward and inward *Surfaces* have to the *Surfaces* of the *primæ viæ proxime*.

5. A fifth Argument is from what *Belini* has demonstrated in his third and last Prop. in his *Section De Febribus*. He there shews continued *Fevers* may arise from a Vitiation in the Quantity, Quality, or Motion, of the Blood; from all or either of these. Moreover, from an Increase or Diminution



minution of the Quantity of the Blood, there will necessarily arise an Augmentation or Diminution of its Velocity. The Motion depends upon the Quantity multiplied into the Velocity, and the Quality arises (for the most Part) from a Combination of the necessary Effects of these. Hence you see, all that necessarily follows upon the whole there may be accounted for from the first of these, to wit, the Increase or Diminution of the Quantity of the Blood.

6. Amputations, Wounds, Fractures, and the like, wonderfully confirm this Doctrine. For there, a considerable Number of the Blood-vessels are stopt, and cannot make their Circle, and consequently increase the Quantity of Blood in the rest: So that generally *Fevers* ensue, if the Quantity be not lessened by letting. It is true, the violent Pain may concur, since all Pain is a *Stimulus*, and *Stimulations* occasion a more plentiful Derivation of the *Liquidum Nervorum*. But if the Quantity of Blood be not supposed to be augmented, that Liquor must necessarily fail in a short Time.

7. WE may see visibly in *Fevers* from Cold, there is a violent Obstruction of the *Glands* of the *Skin*, the *Mouth*, *Larynx*, and *Stomach*: In a Word, of all these *Glands*



to which the cold Air is contiguous, and we can tell whence this Obstruction proceeds; besides this *Fever* may be increased to such a Degree as to differ little in its Symptoms, Violence, or Duration, from other more dangerous continual *Fevers*, which is a clear Demonstration of our Doctrine; for since an evident Obstruction of the *Glands* produces *Fevers* so very like the most dangerous ones; why may we not conclude, that some latent and unknown Cause may produce so general and strong an Obstruction, as is able to occasion all the several more dangerous *Fevers* of this Kind?

8. BUT that which I take to be alone (without any other Proofs) a Demonstration of our *Theory*, is, That in all Countries betwixt the *Tropics*, their Continual or Hot *Fevers* arise from a severe cold Wind suddenly blowing after excessive Gleams of Heat. This is so true, that all Travellers assign this as the cause, having constantly observed their *Fevers* to succeed such sudden changes of the Air. A pregnant Instance of which we have in *Phil. Trans.* for December 1669, N. 259. In a Letter from Mr *Hugh Jones* to Dr *Woodroof*, concerning some Observables in *Mary-land*; his Words are these. “The North-West Wind is very sharp in Winter, and even  
“ in



“ in the Heat of Summer it mightily cools  
“ the Air ; and too often at that Time, a  
“ sudden North-Western Wind strikes our  
“ Labourers into a *Fever*, when they are  
“ not careful to provide for it, and put on  
“ their Garments while they are at Work.”

Thus he. And indeed the genuine Account of the Matter is this ; the excessive Heat must necessarily dilate the *Glands* to which it is contiguous, *i. e.* all the *cutaneous Glands*, the *Glands* of the *Trachea*, *Bronchi*, *Oesophagus*, *Stomach*, and of the *Intestines* ; and it will not only dilate them, but (by the Assistance of the natural Action of these, which is Secretion) exhale their respective Liquors, making them still flow, so long as the excessive Heat continues, and as there is Blood which may supply them : Now they being thus dilated, and (by the *Efflux* of their Liquors) softened and made spongy, a sudden excessive Cold supervening must strongly contract their Orifices, and congeal their flowing Liquors, and the greatness of their Contraction, will be always in Proportion to the Violence of the former Heat and supervening Cold conjunctly ; as is known from the Nature of Cold. And this Contraction of their Orifices, and Congelation of their Fluids, will obstruct the Motion of the Blood almost up to the Heart, at least to the next Division of the *Artery*  
which



which constitutes this *Gland*; whereby both the Blood will be increased as to its Quantity, and perhaps (by this Stagnation of a Part of the same) as to the Quality thereof likewise. All which is but a *Corollary* of our *Theory*.

9. HENCE we evidently see the Reason of the frequency of our last Year's Fevers: For we were then exactly (in Proportion to our Climates) in the state of those betwixt the *Tropics*. Our Summer-Day Heats were more violent than had been observed among us in the Memory of Man, and our Nights had no ways the Heat proportionate to our Days: Besides we had often sudden Changes, which though not so violent as in these warmer Countries; yet had the same (though a slower) Effect as among them: And therefore it was, that frequent Vomittings were found so useful, which (at least in such a Degree as was found then necessary) is not always so safe. The Practice was entirely agreeable to that of these Southern Countries, and the necessity thereof will be understood when we come to speak of *Vomitting*. The same Practice obtains in Fevers, occasioned by Surfeiting or Drunkenness; which is still to be suspected as a considerable Part of the Cause



Cause of Fevers in adult Persons in great Cities.

10. AND generally I should think either the above-mentioned sudden changes (which may happen a Thousand other Ways different from the Season) or a direct continued Fit of violent Cold, or Excesses in Eating and Drinking; one or all of these, have a large Share in most of our Continual Fevers.

11. LASTLY, it is no ways accountable from any other *Theory* (as I think) how these Liquors which are secreted from the *Glands* at the Dissolution of Fevers, could be so different from the ordinary Fluids which are there excerned. From ours it is evident, for an Obstruction of the *Glands* must necessarily make their respective Liquors to stagnate, which will many ways alter their Nature; but from any other *Hypothesis*, I do not see, how this can come to pass; which will lead me to consider one or two of the commonest Opinions about continual *Fevers*.

THE most common and generally obtaining Opinion about Fevers is, that they are more immediately produced by some *Morbific Matter*; (like a Poison) which mixing and circulating with the Mass of the

the



the Blood, produces all those frightful Symptoms which we feel. This Opinion is sufficiently confuted, *Prop. 222, 223, 224. 2dæ. part. of Borelli's Book de Mot. Animal.* whether I refer the Reader; only adding (to what he has there adduced) this one Argument.

WHEN any corrupt Matter is mixed with the Blood, so as to vitiate the whole Mass, (as Vinegar among Water) the way of curing such a Vitiation is either by forming new *Glands* to derive the vitious Part of the Mixture; or by draining the whole Mixture good and bad, and substituting new and pure Blood in it's Place; or lastly, by disposing the already formed *Glands* to secern the corrupted Part.

THE first of these is ridiculous.

SOMETHING like the second is done, when the Blood is really vitiated in the whole; as in inveterate Poxes, but that Cure cannot here have a Place, as shall be afterwards shewn.

As to the third Way, let us consider,

1. How hard it is to think (when the whole Mass is supposed corrupted) that the vitious Part, all at once, or in the Space of  
a few



a few Hours (in which time we know, after a *Crisis*, Fevers commonly leave People) should be entirely evacuated. This is not like the Actions of Nature, which works leisurely and by Degrees.

2. LET us consider, whence all the *Glands* (at least the greater part of them) should be so altered, seeing their Configurations are so different, and naturally they seern so different Liquors, as all at one Time to separate the same *Morbific* Matter. And,

3. How at the *Crisis* only, and at no other Time, they should be so disposed.

IT will be very hard in any other *Theory* (in this more particularly) save ours, to account for these Things, without recurring to Miracles, or the absurd *Metaphoric* Terms of Sympathy, Antipathy, and the like. These then, with what *Borelli* has brought against this Opinion in the forecited Places, are abundantly sufficient to shew the Ridiculousness thereof.

BUT there are several Physicians, who observing, that, in Fevers, there was (by a Vomit) a tough viscid Matter thrown out of the Stomach, have thought this Matter generated there, and mixing with the Mass  
of



of Blood, might be a considerable Part of the Cause of *Fevers*; at least might considerably augment the same; and have from thence brought Arguments for the Necessity of Vomitting in Fevers.

THIS Opinion supposes these Things.

1. THAT the Quantity of the *Morbifick* Matter excerned by a Vomit, before the Administration thereof, was existent in the Cavity of the Stomach, after the same Manner that other Things are, which are derived into the Mass of the Blood, else it could never get thither. This I shall consider when I come to speak of the Operation and Effects of Vomitting.

2. THAT it is least possible, this *Morbifick* Matter may be derived into the Mass of Blood; let us at present consider this.

I know no Way, any thing of any tolerable Consistence can get into the Mass of the Blood, but by the *Lacteal Veins*. It is true, from the sudden Effects of some Spirits, Medicines, and strong Meats, we are certain, that the more refined Parts of these may get into the *Brain*, without going the tedious Circle of the *Lacteals*: But this is done by the reciprocal Motion of the *Nerves*,  
the



the Necessity and Mechanical Operation of which *Borelli* has demonstrated, *Prop.* 155, 157, 160. 2dæ. part. *de Motu Animalium*. However, I think none will pretend such a Course for this viscous *Morbifick* Matter: And therefore if it gets into the Mass of the Blood, it must go the common Road of the *Lacteals*.

To decide the Matter, I must suppose my Reader to have considered the two last *Prop.* (*Ex iis quæ ad separationes*) which *Bellini* has in his *Preface* to his Book *De Urinis & Pulsibus*, &c. and the 27, 28, and 40, of his last Book *De Motu Cordis*, &c. where the Construction of the *Glands* and the manner of Separations are demonstratively unfolded, which I take to be the noblest Discovery (in these Matters) of this Age. From these Places it is clear, that,

*Prop.* 1. A *Gland* is nothing but a great many Complications and Circumvolutions of the *Artery* (all over the Coats of which little Branchings of *Nerves* pass, designed principally for the spiral Contortion thereof; that the Blood may be the more easily propagated through the same: But this is common to all the *Arteries* and *Veins*, whereby, without any Interruption of the same Spire, the Propagation of the Blood, in the former, from the Heart to the Extremities of  
the



the Body, and from the Extremities to the Heart back again, in the latter, is assisted) which sends out, from the Sides thereof, little secretory Canals, which terminate in one common Conduit, and is called the *Emissary* of the *Glands*; or perhaps in a common *Pelvis* (as in the *Kidneys*); and the same *Artery* after these Windings degenerates into a *Vein*.

*Prop. 2.* That Separation or Secretion is performed by the Composition of two Motions in the Fluid; one propagated through the Length of the Canal; another transversely through its Sides (for it is demonstrable that all Fluids press *undiquaque* and that the Direction of their Pressure is perpendicular in every Point to the Sides of the containing Vessel). The Composition of which two is the Motion (or rather Direction) of the separated Fluid.

*Prop. 3.* That in a mixt Fluid, consisting of greater and lesser Cohesion of Parts, of greater and lesser Fluidity: That which has the least Cohesion and greatest Fluidity is first separated (*i. e.* is separated in the *Glands*, whose compounding *Artery* is shortest, or at least Distance from the Heart, or Fountain of Motion) and these of the next Cohesion, and next greatest Fluidity are



are next separated ; and so on : The Distances from the Heart being in a compounded Proportion of these.

*Prop. 4.* That the *Intestines* are really such a *Gland*, and the most visible one in the Body, whose secretory Vessels are the *Lacteals*, and whose common Conservatory or *Pelvis* is the *Receptaculum Chyli*.

To these I shall add (because of its Affinity) the following.

*Prop. 5.* The Quantity separated in every *Gland*, is in a compounded Proportion of the Celerity of the Fluid at the respective Orifices ; and of the Orifices themselves, of the separating Canals.

I shall here subjoin the Demonstration of this Proposition ; referring (that of) the rest to their Author.

## DEMONSTRATION.

THE Orifices being given, the Quantity separated is as the Celerities of the Fluid : For in a greater Celerity, there is a greater Quantity separated ; in a less Celerity, lesser Quantity. The Celerities being given, the Quantity separated is, as the  
E
Orifices



Orifices directly, for at a great Orifice there is greater Quantity separated, at a less Orifice a lesser Quantity: And therefore neither being given, the Quantity separated is as the Celerities, and the Orifices conjunctly, *q. e. d.*

FROM all these I draw the following

### *C O R O L L A R I A.*

1. **T**HE separated Fluids differ only in their Degrees of Cohesion and Fluidity, *per Prop. 2.*

2. THE Reason, why Fluids of different Degrees of Cohesion and Fluidity, are separated in such and such *Glands*, is the different Degrees of the Velocity of the Fluid at the respective Orifices of the separating Vessels, and the Differences of the Orifices themselves, *per Prop. 3.*

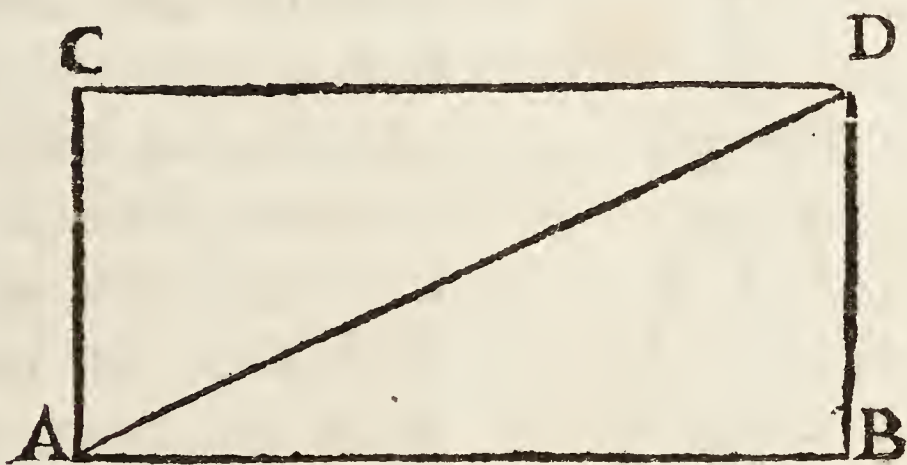
3. THE *Glands* themselves differ only in the Length of the *Artery*, the Difference and Number of its Complications and Convolution, *per Prop. 1.*

4. EACH *Gland* (naturally and equally working) separates only the Fluid proper to it self; *i. e.* peculiar to such Lengths and Complications, of such Degrees of Fluidity or Cohesion, to such Bigness or Smallness of  
the



the Orifices of the separating Canal; *per Prop. 3. and 5.* But this last is of small Consideration.

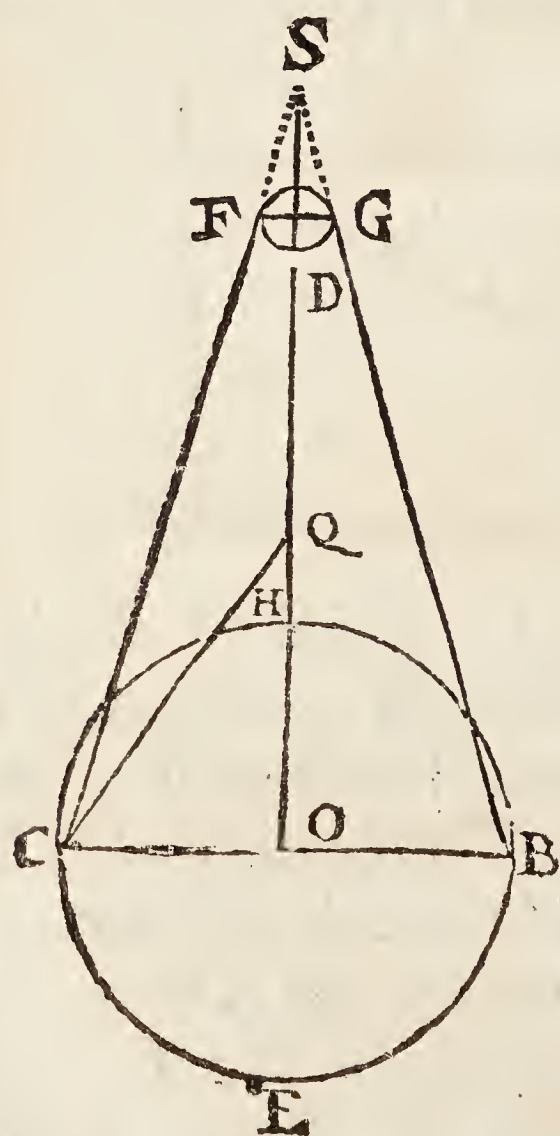
5. THAT Secretion may be performed the most easily that may be, the Insertion of the separating Canal ought to be at an *Angle* of 45 Degrees with the *Artery*, *per Prop. 2.* For let A B represent the *Artery* (if it makes a Right-line) or its *Tangent* (if it makes a Curve) and let the Motion of the Fluid be from A to B, the Right-line A B will likewise represent its Direction pro-



pagated from the Heart. Erect at A the Perpendicular A C; this will represent the Direction of the lateral Preffion of the Fluid. Compleat the Parallelogram A B C D. The Direction of the Composition of these two Motions will be the Diagonal A D, as is known; which in the present Case makes an Angle of 45 Degrees with the *Artery* A B. This were well worth the observing (if it be possible) in Animals; but



it must be in live ones, before their Part<sup>s</sup> have altered their Positions. And here it were worth the examining likewise, whether what Sir *Isaac Newton* has demonstrated (*Schol. prop. 35. lib. 2. Princip. Phil. Mathem.*) about the Resistance *Conical* Figures obtain in Animal Bodies; for, though his Demonstration be only concerning *Convex Cones*, yet the same obtains in *Concave* ones; wherefore seeing the *Artery* betwixt any two *Branchings* is a *Conus truncatus*, it may be represented by the Figure *C E B G F*; now



seeing the Diameter *CB* of the Base of this *Conus truncatus*, and the Diameter *FG* of the Base *F D G* of the *Conus abscissus F D G S*, as likewise their Distance, *OD*, may all be had; it is evident, that the entire *Cone C B G S H* may be had likewise: Wherefore bisect the Distance *OD* in *Q*; and if it be found (having drawn *C Q*) that *Q S* is equal to

*Q C*, then the *Conus truncatus C E B G F* (among all of the same Base and Altitude) gives



gives the least Resistance to the Blood flowing from O to D. I am inclined to think this may obtain in the Trunks of the great *Arteries*, betwixt their branchings (for no further is to be considered). This I recommend to be examined for the Honour of that great Man, who has crouded up in this *Scholium* (not to mention the rest of his admirable Book) a vast number (if retailed) of most charming and useful Truths.

To come now to the Business: The *Testiculi Humani* are granted by everyone to be *Glands*; and *Bellini* has found the Length of the complicated *Artery* in one of them, to be 300 Ells, and the Altitude of one of these *Glands* (when freed of its Integuments) to be  $\frac{1}{6}$  Ell: Whence I conclude, there must be 4800 Plications or Circumvolutions in one of these, *proximè*. He likewise asserts, That (*cæteris paribus*) if two Fluids of the same Nature, with equal Velocities, the one be forced into a Canal of the same Number and Lengths of Complications, as are in the foresaid *Gland*, and the other into a strait Canal of the same Length; the Velocity (in or about their *Exits*) of the first Fluid, to that of the second, will be as 1 to 4800. He has not indeed subjoined the Demonstration, but if



we suppose the *Artery* to lie in *Plicæ*, or Folds, of such Number and Lengths, as we have just now determined; (which is perhaps not far from Truth) and we suppose the Turnings of the *Plicæ* to be circular; (which perhaps may follow from this, That seeing a Circle is the only ordinate Figure of an infinite Number of equal Sides, and equal Angles; it must be the only *Curve* which can make (in all its Parts) the Angles of *Incidence* equal to the Angle of *Reflection*, and consequently the only *Curve* in which a Fluid would most easily turn) and likewise the Arch in which they turn to be a Semi-circle; (which it must be, if the Sides run parallel after the turning; and universally, if the Sides produced make any Angle from the Quantity thereof, the Quantity of the Arch in which they turn may be determined) I say, from these *Data*, the former Proportion may be by Calculation examined; or perhaps, more briefly by Experiment, thus,

TAKE a Pipe of Metal of any Diameter, and fold it into any determined Number of *Plicæ*, whose Sides may run parallel, and whose Lengths may be  $\frac{1}{16}$  Ell: Then, by a Weight, force a Liquor through it, and observe the Time betwixt the first Entry of the Liquor into the complicated Canal, and  
its



its first Appearance at the other Orifice; then take another strait one of the same Length with the former, and with the same Weight force the Fluid through it, observing the same Way, the Time of its Passage, the Lengths being the same, the Velocities shall be as the Time of passing reciprocally, as is known. Having thus got the Proportion of their Velocities in any one determined Number of *Plicæ*, we may (by the *Rule of Three*) have their Proportions, in any assigned Number thereof. Supposing then that this great Man has found the Truth of the aforesaid Proportion from some such Way, as one of these; it follows, that in every turning, the Velocity must be abated  $\frac{1}{4800}$  of the whole, *proximè*: (for  $4800 : \frac{4800}{4800} :: 4800 : 1$ .) Now let us suppose the Proportion of the Cohesion, and Fluidity of the Fluid separated in the *Testiculi Humani*, to the Cohesion and Fluidity in our *Morbific* Matter, now derived from the Stomach into the small *Intestines*, to be as 1 to 3. (I mean the Cohesion and Fluidity of the Fluid separated in the *Testiculi Humani*, as it is when immediately separated. For when it has lodged any Time in the *Vesiculæ spermaticæ*, we know by its Ebullitions and the Evaporation of its thinner Parts, it loses a great deal of its Fluidity.) And that this is a liberal Allowance is evident from *Leu-*



*wenboek's* Experiments scattered up and down the *Phil. Transf.* and printed all together at *Amsterdam*; where we may see from the *Microscopical* Observations he has made on this Fluid, its Fluidity is little less than that of common Water: And consequently, at least, ten Times more than that of our *Morbifick* Matter.

AND here I hope it will not be impertinent, to set down a Proposition to compare the Viscidities of different Liquors.

### P R O P O S I T I O N.

**L**ET two Drops of two different Liquors fall into a Pair of fine Scales; (a Drop of the one Liquor into one Scale, and a Drop of the other Liquor into the other Scale) so that there fall no more than just their own Gravities carry down: Thus you shall have, what I here call, their comparative Gravities: and by the ordinary Method you may likewise have their Specific Gravities. These being given; I say, their Viscidity and Cohesion shall be in a compounded Proportion of their Specific Gravities reciprocally, and their comparative Gravities directly. The Demonstration is easy from the Nature of Fluids.

LET



LET us again suppose the Length of the small Guts, (for it is there only where any Thing is separated from the *Intestines*) to be 6 Yards; and that in every  $\frac{1}{16}$  of a Yard, there is a Plication: (And that these are likewise liberal Allowances; any who have ever seen a Dissection will know) Then there will be 96 Plications in the whole; and consequently the Fluid in these *Intestines* will lose but 96 Parts of the whole Celerity it had at its Entry.

*Lastly*, Let us suppose that Celerity to be equal to the Celerity of the Blood, when it first enters the Plications of the *Testiculus Humanus* (which all will readily grant, who consider, that there is never any Thing found in these small Guts, but a thin Liquor in a wide Canal, thrust forward by the Force of the *Fibres* of the Stomach and *Intestines*). Let us call this Celerity *a*.

Now from *Corol.* 1, 2, and 3, about Separation; if a Viscidity, as 1 gives 4800 Plications, then a Viscidity as 2 will give 9600 such: And therefore, that such a viscid Liquor should be separated, it is requisite it should lose 9600 Parts of the whole Celerity: But (as has been just now shown) by the *Plicæ* of the *Intestines*, the  
Fluid



Fluid will lose but 96 Parts of the Celerity *a.* Whence it is absolutely impossible that the *Intestines* should separate this viscid Matter, unless they were a hundred Times longer than they are: For  $96 : 9600 :: 1 : 100$ . If the Viscidity of the Fluid, separated in the *Testiculus Humanus*, were to that of our *Morbific* as 1 to 10, then the small *Intestines* ought to be five hundred Times longer than they are. And indeed I believe the Proportion really not to be under 1 to 50; and then they ought to be at least 25 hundred Times longer than they are.

THUS we see the second Thing (this Opinion supposes) is false? and indeed, it hardly could be otherwise; for (in my Opinion) the *Fæces* themselves might more probably get into the Mass of the Blood, than this viscid Matter, the Parts of those being only united by a simple Contact; whereas the Parts of this are joined by a very strong *Nisus*. And I remember, Dr *Lister*, somewhere in the *Phil. Trans.* relates how he tryed to get in a very fine tinged Spirit into the *Lacteals* of a live *Dog*, by cutting the small Guts, and injecting the Liquor, then sewing up all again: But he could never get it done to his Satisfaction. And it is to be observed, that People may  
be



be deceived with blue Tinctures; for this is the Natural Colour of these *Lacteals* when they are almost or altogether empty.

IF it be objected, 1. That the Concoction of the Stomach and *Intestines* may fit this *Morbific* Matter, to be separated by the *Lacteals*. 2. That the *Peristaltic* Motion and the *Valves* of the *Intestines* may hinder the quick Motion of the compounded *Chylous* Matter. 3. That there are some Medicaments, as *Turpentine*, &c. which we know, by their Effects, get into the Mass of the Blood, and yet are more viscid than our *Morbific* Matter. 4. That there is really as viscid Matter separated in some other *Glands*, as the *Bile* and the *Pblegm*.

*To these I answer,*

1. As to the first; seeing *Triture* is the only Effect of the Stomach and *Intestines*, there is no Advantage to be reaped thence; for no beating nor grating will dissolve the Union of this *Morbific* Matter. Besides, where it is in any Plenty, the Effects of Concoction are very small, or none.

2. As to the second; The *Peristaltic* Motion being reciprocal, it adds as much (to the Motion of the *Chylous* Matter) in its  
Descent



Descent towards the *Rectum*, as it takes away, in its Ascent towards the Stomach; and so cannot serve that End, the *Plicæ* and Circumvolutions of these *Intestines* (which we have considered) being only to be relied on for this Purpose. As to the *Valves*, we know they all open toward the *Rectum*, and serve only to stop the Ascent of the *Fæces* in the Peristaltick Motion, and so cannot retard the Motion of the *Chylous* Matter.

3. As to the third; we likewise know, that all these Medicaments are dissolved into a thin Liquor by Heat. (as *Turpentine*, *Butter*, &c.) Besides that only the most spiritous and least viscid Parts enter the Blood; which is not said of our *Morbific* Matter.

4. As to the last; there is a great Difference betwixt a Liquor immediately after it is separated, and when it has stagnated some time in the Conservatory of the *Gland*; for then the aqueous and more humid Parts evaporate; and by its Stagnation it acquires an Ineptitude to Motion: And though the Blood flows very easily in the *Arteries* and *Veins*; yet I defy any to cause extravasated Blood to enter its Vessels again. But more particularly, we must consider the *Liver* to be a very large Vessel, and (if it were evolved)



ved) to make an *Artery* many thousand Times longer than that of the Canal of the small *Intestines*, or *Testiculus Humanus* either; and so it is no wonder if it separates a viscid Matter; the Motion of the Blood there being very small: But still I assert it is not near so viscid as our *Morbific* Matter is. As to the *Phlegm*, we know it is not naturally produced; and the *Morbific* Matter it self (against which we dispute) might be as well objected; for it is only the Stagnation, Corruption, and Evacuation of the Humidity which occasions both; the same might be said of the purulent Matter which passes by *Urine*, but that we know it proceeds from an *Ulcer* in the *Kidney*, or Neck of the *Bladder*, and is not discerned with the *Urine*.

HAVING dwelt thus long on the Opinions of others, I come now to consider the proper Remedies of Fevers, which I reduce to, 1. *Blood-letting*. 2. *Vomitting*. 3. *Purging*. And, 4. The *Medicaments* which increase the less *sensible Evacuations*; under which Head I comprehend Sweating, Perspiration, and the like.

I do not here consider Blistering and outward Applications; seeing (in my Opinion) they are only useful to remove the accidental Effects,



Effects, and not the Cause of Fevers, without which they cannot be said to be truly cured.

1. As for *Blood-letting* ; The Subject is so fully and learnedly treated by *Bellini* in his forementioned Books together ; that it were equally impossible as impudent to offer at any Additions : And therefore for entire Satisfaction on this Head, I shall refer my Reader to these Books.

2. As to *Vomitting* ; I shall comprehend all I have designed to say about it in these Particulars. 1. I shall show that Vomiting is partly produced by the *Vis stimulan Vomitorii* : But, 2. That is mostly occasioned by the *Vis stimulan* of the *Morbific Matter* excerned from the *Glands* of the Stomach. 3. I shall prove that this *Morbific Matter* is not in the Cavity of the Stomach (at least in such Plenty as it is excerned by a forced Vomit) before the Ingestion of the said Vomit. 4. I shall give the whole Destruction and Connexion of this Operation ; And, 5. Shall consider the Advantages of the same in the Cure of Fevers.

BEFORE I come to handle these, it is necessary, I first explain what I here mean by a *Vis stimulan*.

By



By a *Vis stimulans*, I understand such Quality in a Fluid, whereby the Particles thereof are disposed to make a real Division or a violent Inflexion of the *Nervous* and *Membranous Fibres* of the Body, which occasions frequent and forcible Reciprocations, Successions, and Derivations of the *Liquidum Nervorum* into the *Muscles* and contractile *Fibres* of the Canals; whereby all the involuntary *Muscles* are brought into violent Contractions, and the Emissaries of the *Glands* are squeezed.

THOSE who desire a fuller Account of the Nature and Mechanical Operations of this *Vis stimulans*, may see it, *Pag.* 165, &c. of *Bellini's Book De Urinis & Puls. & Prop.* 52. of his last Book *De Motu Cordis*. I say then,

1. *Vomitting* is partly produced by this *Vis stimulans Vomitorii*; This is evident from these Considerations. 1. Because sometimes we immediately vomit upon the Ingestion of the Vomitory, before the *Morbific Matter* excerned from the *Glands* of the Stomach could have time to concur. 2. We throw up very often the same we had taken in, with little or no Mixture; which could not happen, if the *Morbific Matter* had  
had



had concurred to produce the Fit. 3. Sound Persons (in whose Stomachs there is little or none of this *Morbific* Matter) often vomit upon a too plentiful Ingestion of an (otherwise) inoffensive Liquor. The only Reason of which must be, that that the Stomach not being able to derive into the Mass of the Blood the said Liquor, so fast as it is poured in, it must sour on the Stomach, and thereby acquire this *Vis stimulans*, whereby it is thrown out: Or perhaps it may still have a *Vis stimulans*, though not (when it is in a small Quantity) sufficient to bring the Stomach into that violent Contraction which is necessary in Vomitting; But this small *Vis stimulans* being multiplied by the too great Quantity of the Liquor, may acquire sufficient Force to produce the Effect; as we see several things lose the Quality to produce their visible Effects; when in small, which they had when in great. But, secondly,

I say, Vomitting is mostly occasioned by this *Vis stimulans* of the *Morbific* Matter excerned from the *Glands* of the Stomach; and that for these Reasons, 1. The Action of the *Vis stimulans Vomitorii* being terminated at, or near, the internal Surface of the Stomach, after one or two plentiful Fits of Vomitting, (there being produced thereby  
such



such a Succussion and Compression of the Sides of the Stomach) these *Particulæ Stimulantes* must necessarily be disentangled; and so there could be no more Fits of Vomitting, which is contrary to Experience.

2. We evidently see in Sea-vomits, and in those produced by the Joltings of a Coach in some People, there is no *Vis stimulans Vomitorii* to which we can attribute this Effect; and therefore it must necessarily be produced by the vellications of the Morbific Matter excerned by this particular Motion. The Manner of which may be thus explained, every particular Body has a determined Degree of Tension, and a determined Length. And if a like Reciprocation of Motion (by whatsoever Cause) be produced in the ambient *Medium*, which would necessarily be produced by another Body (when moved) of the same Degree of Tension, and of Length commensurable to the Length of the first Body, there must be of necessity a Motion produced in that first Body, especially if the Motion of the *Medium* be violent, and the commensurable Lengths be as the first Numbers of the ordinary Arithmetical Progression, 1 to 2, or 1 to 3, or 2 to 3, &c. This is evident in the unison or concordant Strings of greater Musical Instruments: And the Reason is, because thereby the *Oscillations* of

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such



such Bodies become commensurable. Now I suppose this particular Motion of jolting Coaches and Ships, to be such, as would be produced by another Body, having the just now mentioned Analogy to the *Nerves* of the *Glands* of the Stomach, whereby they are brought into Motion, and consequently derive great Plenty of their *Liquidum* into the Places, which makes such Contractions as squeeze these *Glands* of the Matter, which produces these Fits of Vomitting: Besides, that the same cause may (upon other *Fibres*) produce the antecedent Sickness which we feel in Sea-Vomits. 3. By a Vomit of warm Water (for example) there are often produced several Fits of Vomitting; and yet we all know there is no *Vis stimulans* in it: So that all it can do, is, that by its Warmth (which is a kind of a *Fotus*) it elicits the Matter from the *Glands* of the Stomach, which occasions this vomiting. I could add a great deal more to confirm this Proposition, but I think this sufficient. I say,

3dly, THAT the *Morbific* Matter (excerned by Vomitting) is not existent in the Cavity of the Stomach, (at least in such Plenty, as it is excerned by a forced Vomit) before the Administration thereof. I. This is an evident Corollary from the former *Prop.*  
The



The Vomit does not act (at least after the first one or two Fits) by it's own *Vis stimulans*; there is (in Vomitting) produced a violent Contraction of the *Fibres* of the Stomach, the *Muscles* of the *Abdomen* and *Diaphragm*, which must be occasioned some Way. There is nothing (in Vomitting) which can occasion this, but either the *Vis stimulans Vomitorii*, or of the excerned *Morbific Matter*; and since (as has been already proved) it cannot be the former, it must of necessity be the latter: Wherefore if the *Morbific Matter* were already existent in the Cavity of the Stomach, the Vomit were of little use after one or two Fits; which is contrary to Experience. 2. If this *Morbific Matter* were already in the Cavity of the Stomach, it is not possible, but that one or two plentiful Fits of Vomitting, would eject all that is there; so that afterward there should none be thrown out, however violent the consequent Fits were, which is likewise contrary to Experience. The Force of the *Muscular Fibres* of the Stomach, the *Muscles* of the *Abdomen* and *Diaphragm* (which two last Monsieur Chirac, Professor of Medicine at Montpellier, by an easy Experiment, has shewn to concur principally in vomitting. vide, *The Preface of Tournefort's History of Plants growing round Paris*) is at least equal to



260000 *lib.* Weight; (the Force, of the *Muscles* of the *Abdomen* and *Diaphragm* being more than that of 248000 *lib.* and of the *Stomach*, not inferior to that of 12000 Pounds) which Force if it be not sufficient to drive out all that is existent in the Cavity of the *Stomach* (however viscid the Matter be) I leave every one to judge. 3. Supposing the *Morbific* Matter already in the Cavity of the *Stomach*; it is impossible to give an Account of the different effects of different Vomits: For Example, why an *Antimonial* Vomit does excern this *Morbific* Matter more plentifully than Whey or warm Water. For if before the Ingestion of either, the *Morbific* Matter is already in the *Stomach*, then the only thing left for them to do, is, to excite the Act of Vomitting: But it is certain they may be both brought to be equal in that, *i. e.* they may be both brought to excite an equal Number of Fits of Vomitting; and that with equal violence (by taking their Quantities in a reciprocal Proportion to their Vomitive Faculties). And yet their Effects be very different, otherwise I omit (for avoiding Tedioufness) the other Arguments I can produce to confirm this Proposition.

4thly, THE whole Deduction and Connexion of this Operation is thus: The Particles



ticles of the Vomitory by their *Incuniation* into the Orifices of the *Emissaries* of the *Glands*, adjacent to the Surface of the Stomach, do dilate the same (which by some extrinsic Cause) had been contracted, and after the same Manner do dissolve (at least in some Degree) the Cohesion of the stagnant *Morbific* Matter, and render it more fluid; and consequently, its Resistance less: Now, the natural and constant Action of the *Glands* being Secretion; and the *Impedimentum* (by the Dilatation of the Orifice and Attenuation of the Fluid) being totally taken away, or (at least) made less than the natural *Momentum* of the *Glands*; the Matter must necessarily flow into the Cavity of the Stomach, till it be accumulated in such a Quantity (which not being to be done in an Instant, must require some Time) as is sufficient (by the united loathsomeness and the *Vis stimulans* of it, and the Vomitory) to vellicate and force the *Fibres* of the Stomach, *Abdomen*, and *Diaphragm*, by the Communication of the *Nerves* of the first with the two last) into a violent Contraction, and thereby throw all out by the *Oesophagus*, which brings all to quiet again, till there be a new, a sufficient Quantity excerned from these *Glands* to reproduce the aforesaid Contraction: And thus there happens a Fit of Vomitting and Quiet alternately, till either



all the *Morbific* Matter be thrown out, or the Force of the Vomit so diluted, that it is no longer able to elicit the *Morbific* Matter from the *Glands*. Besides these primary Effects of Vomitting, there are two others, which ought not (though less principal) to be omitted. The first is, that in a strong Vomit, or in one which requires some considerable Time before it operates, there often passes some part thereof from the Stomach into the *Intestines*, and occasions a gentle Purge, by dissolving the *Fæces*, and vellicating the *Fibres* of the *Intestines*, as shall be more particularly shown when we speak of *Purging*. However, the Effects of this purge very seldom, or never go beyond the *Primæ Viæ* ; for all gentle Purges (of which this is one) are confined within these. The second is, that the strong Contraction in so many *Muscles* and *Muscular* Canals, which are at Work in vomitting, and the violent Concussion which is produced over the whole Body, by a Power (as has been said) which is not inferior to that of two Hundred and Sixty Thousand Weight, may and often does, take away the Obstructions in many other Canals, than those which are more immediately concerned about the Stomach and *Oesophagus*, as we evidently see by that vast Sweat which  
always



always breaks out after plentiful Fits of Vomitting. From these I deduce,

5<sup>thly</sup>, THE Advantages of Vomitting in the *Cure* of Fevers; which are, 1. The taking away the Obstructions of the *Glands* of the Stomach, and (sometimes) of the *Intestines*, which is the principal use of vomiting; and how great a Step this is toward the Cure of Fevers, every one will see who considers, that in Fevers occasioned by Intemperance, the Stomach is the Scene where this great Mischief is both contrived, and put into Execution; the Obstruction of the *Glands* thereof, being the first and principal Cause of these Fevers; and in Fevers occasioned by Cold, the Stomach and *Intestines* being most exposed, and least defended from the cold Air, receives its first and strongest Impressions; which two (as formerly was said) have the most considerable Share in the Cause of our continual Fevers; And therefore it is, that vomiting (being timely and plentifully used) very often prevents such Fevers. 2. Another Advantage of Vomitting is, that by the strong Contraction of the *Muscles* and *Muscular* Canals and the violent Concussions of the whole Body thereby produced, the Obstructions of many other *Glands* are removed, (as has been just now shown) so that this with the former

F 4                      (removing



(removing so considerable a part of the Cause) enables Nature to perform the rest very easily.

3. A third Convenience (if not Advantage) of Vomitting is, That it is less dangerous than many of the Medicaments that are taken inwardly; The Effects of this is confined to the *Primæ viæ*, (by which I always mean that winding Canal, which is continued from the Mouth to the *Sphincter Ani*) and is consequently less dangerous than those which run the Circle of the Blood; for it is not to be doubted, that all alterative Medicines have more or less Danger in them (from the Effect of their Stimulations upon the *Nerves*, their Fermentations with the Blood, their separating, or promoting the natural Cohesions of the Liquors of the Body, and their many other unknown Productions). That which goes out the least way, must therefore have the least Danger: Now, since it is certain, that Vomitting does not go out of the Stomach and *Intestines* (where the Canals are strong and wide, and the Fluids are viscid and gross) there must of Necessity be less Danger in it, than in these which enter into narrower and weaker Canals filled with more fluid and finer Liquors. It is true indeed, there is some Hazard from the bursting of the Capillary Vessels of the internal Surfaces, by the violent Concussion of the Body, occasioned by Vomitting;



ting ; but this is easily prevented by Blood-letting which ought always to precede the plentiful use of Vomitories in all Diseases. Besides, sometimes the Violence of the Vomit, is too great for the Strength of the Patient ; but this is rather the Fault of the Physician than the Physick : For the Strength, and (consequently the Violence of Vomits, as of all other Medicines) ought to be adjusted by this Proportion, *viz.* They ought to be in a compounded Proportion of the Strength of the Patient, and the Danger of the Disease. If this were observed, none could ever err in the Administration of Medicines.

III. COME we now to that which we called the third proper Remedy of Fevers, to wit, *Purging* ; in explaining of which, I shall, 1. Shew that vomitive and purgative Medicines differ only in Degrees of the same Quality. 2. I shall give a short Account of the several Steps, and of the Manner of this Operation. And, 3. Consider its use in the Cure of Fevers. I say then,

I. THAT vomitive and purgative Medicines, differ only in the Degrees of the same Quality, *i. e.* Purgative Medicines, by increasing their Force vastly, and confining it to a lesser Quantity, either of a fluid or solid



lid Body, become Vomitive, and vomitive Medicines (if diluted) become Purgative. This will be evident from these Considerations.

1. WE find by Experience, a strong Purge never misses (if either it be very strong, or the Patient not very strong) to vomit, and the weaker part of a Vomit, which escapes into the *Intestines*, does frequently purge us. 2. The same Medicines (for Example, *Vinum Emeticum*) taken by the Mouth, will provoke Vomitting, which given by way of *Glister*, will purge: The same obtains in all strong Emetics. In short, all strong Medicines of either kind constantly produce both these Effects. The Reason of all which is this; if the Medicament of either kind be so strong as immediately to vellicate and stimulate the *Fibres* of the Stomach, to dilate the Orifice, and attenuate the Matter contained in the *Glands* thereof, it produces Vomitting; if it act but gently, so as only to assist the natural Motion of Digestion, it goes by the *Intestines*, and dissolves the Cohesion of the *Fæces*, and finding there more sensible *Fibres*, is able to bring them into violent Motions, which produce purging, as shall be just now shown. 3. It is impossible in any other *Theory*, to account how these two different Medicines, should  
upon



upon the same Parts produce different Effects: For both these Medicines are taken by the Mouth, go down the *Oesophagus*, and enter into the Stomach, either in the Form of a *Liquid*, or are there by it reduced into a *Liquid*; and consequently are brought into contact with, and operate on, the same *Fibres*, *Glands*, and *Membranes*; and yet produce (by their Assistance) two different Effects. It is simply impossible to explain the Manner of this, without saying the one acts more powerfully and forcibly, and makes more violent Contractions, and consequently is thrown up the most patent way; the other more gently and softly, and has thereby time to seek out the less obvious Passages.

2dly, THE Account of the several Steps, and of the Manner of this Operation, is thus; Purgative Medicines, being received into the Mouth, and admitted into the Stomach, their Particles vellicate and stimulate the *Fibres* thereof, and thereby increase the digestive Faculties, *i. e.* bring the *Muscular Fibres* of the Stomach, the *Muscles* of the *Abdomen* and *Diaphragm* into more frequent Contractions than ordinary, till they are admitted into the *Intestines*, the *Fibres* and *Glands* of which being more sensible than those of the  
Stomach



Stomach (whose Parts by the frequent rough Contacts, of one against another, and of the gross Bodies which are often thrown into it, are as it were deadened) they easily move and bring into frequent and forcible Contractions, whereby these *Glands* are squeezed of a Fluid, which lubricates the Passages; and mixing with the feculent Matter of the *Intestines*, which is rendered Fluid by the same active and stimulating Quality of the purgative Medicine) renders it yet more fluid, by which (and by the more than ordinary Contractions of the *Intestines*) it passes more plentifully and easily into the *Rectum*, and is thence ejected. This is the use of the more gentle Purges which only cleanse the *Intestines*. But those of more Force (besides all these) do (as to the greater and more spirituous part) enter into the Mass of the Blood by the *Lacteals*, and mixing therewith produce many unnatural Fermentations therein, separating or promoting the natural Cohesions of the Liquors of the Body, and occasioning many other unknown Effects, as has been formerly said: And likewise there, vellicating the spiral *Fibres* of the *Arteries* and *Veins*, bring these into more forcible Contractions, and thereby promote the Circulation of the Blood, and make it run with greater Velocity



locity and Force ; and by this Means in a short Time wash away any Obstructions that either happen to be in the more direct *Arteries*, or the more complicated ones which constitute the *Glands*, increase the insensible Perspiration, and purify the Blood of all the grosser and more noxious Parts, by the *Ductus Chylodochus* and *Pancreaticus*, which void themselves into the *Intestines*. All these Effects of the more powerful Purgatives are visible ; for sometimes after one has taken such a strong Purge, we find the Pulse mightily increased, the Perspiration augmented, the Spirits, or *Liquidum Nervorum*, spent, the visible Excretions by Sweat and Urine much greater, and the Body weakened ; especially after a few Days of such a Course. Whereby it is evident, these Medicines must operate after the Manner now explained. From hence it is clear,

3<sup>dly</sup>, THAT the Advantages of purging in the Cure of Fevers are very great, upon these two Considerations. 1. If the Purge be more gentle, so that it only serves to cleanse the *Intestines*, it partly takes away the Obstruction of the *Glands* of the Stomach, and totally that of the *Glands* of the *Intestines* ; which is a considerable Step towards the Cure. But, 2. If the Purge



Purge be more violent, so that it enter in any Plenty into the Mass of the Blood, it conduces so much toward the Removal of the Obstructions of most of the other *Glands*, that Nature is able to perform the rest very easily her self. But alas! This Case has so much Danger, and so many Inconveniencies in it, as render it as unsafe as otherwise (if these could be removed) it would be useful. *Bellini*, in his Book *De Urinis & Pulsibus*, pag. 222. has demonstrated, that in violent Purges there is a greater Danger by far than in Blood-letting. His Words are, “ *Quia vero quic-*  
“ *quid est suspicionis in missione Sanguinis*  
“ *ad solum fermentationem non naturalem,*  
“ *qui possibilis per ipsam est in reliquo San-*  
“ *guine redigitur, & hoc uno de nomine*  
“ *periculo non vacat; si igitur hujus mali*  
“ *suspensione careret purgatio, illa potius*  
“ *adhibenda, quam venæ-sectio; cum purga-*  
“ *tio ejus loco cæteroquin esse possit: sed*  
“ *res è converso se habet, suspicio enim ejus*  
“ *mali à missione Sanguinis est suspicio rei*  
“ *possibilis non tamen necessario provenientis,*  
“ *aut necessario conjunctæ, cum qualibet*  
“ *missione Sanguinis; in purgatione autem*  
“ *necessarium semper est Sanguinem solvi à*  
“ *naturalibus Cohæsionibus, seu recedere &*  
“ *dimoveri à sua compositione; In Purga-*  
“ *tione igitur periculum erit certum, in*  
“ *venæ-*



“ *venæ-sectione dubium: hoc est, erit Pur-*  
“ *gatio venæ-sectione periculosior, &c.*” And  
there he goes on to shew how much more  
dangerous Purging is than Blood-letting.  
From this, and a great deal more, he has  
there adduced, it is evident, 1. That vio-  
lent Purges have a great deal of real Dan-  
ger in them absolutely, without respect to  
other Remedies; and these unnatural Fer-  
mentations and Changes of the Cohesion of  
the Fluids, instead of promoting the Cure,  
often increases the Cause of Fevers, to wit,  
the Obstruction of the *Arteries* which con-  
stitute the *Glands*. 2. That violent Purges  
are respectively much more dangerous than  
Blood-letting; wherefore this last is a more  
safe, and consequently a more useful Ex-  
pedient in the Cure of Fevers, than the  
former. And I say, 3. That violent Pur-  
ges are a much more dangerous Remedy in  
Fevers, than Vomittings are; for Vomits  
extend no farther than the *Primæ Viæ*,  
where Canals are strong and wide, the  
Fluid viscid and gross; but violent Purges  
reach all the slender Vessels and noble Li-  
quors of the Body, where the Danger of  
any considerable Alteration is extreamly  
great. Wherefore upon this Account, I  
say, that the Danger of violent Purges is  
to that of Vomitting, as the Length of the  
Canals of the whole Circuit of the Blood,  
is



is to the Length of the Canals of the *Primæ Viæ*. And how much longer the first is than the latter, I leave the Reader to consider. Besides all these, there are so many other known and evident Dangers in violent Purges, that the only Part of Purging, which is safe (in curing Fevers) is *Glistering*, or the *Lotiones Alvi*, or rather than either of these, only that gentle Purge, which is the concomitant of every plentiful *Vomitting*.

IV. WE are come now to the last proper Remedy of Fevers, which was the *Medicaments which increase the less sensible Evacuations*. But all that can be pertinently said on this Head ; is so learnedly and accurately already handled in a Treatise intitled, *Archibaldi Pitcarnii Dissertatio de Curatione Februm, quæ per Evacuaciones, instituitur*, that thither I shall refer the Reader, only adding the Reason why such Medicaments administered in the Beginning of Fevers, do rather increase than cure them, which is this: In an Obstruction of the *Glands*, the Blood in the complicated *Arteries* which constitutes the same, stagnates up to the next Branching thereof, nearest the Heart ; and thereby a considerable Length thereof becomes obstructed and unpassable ; the only way this Obstruction can  
be



be removed is by the Force of the Blood, which in every Pulse or Contraction of the Heart, washes off a Particle of the same till the whole be digged away ; as shall be shown. Now the *Arteries* which constitute the *Glands*, whereby the insensible Evacuations are naturally secreted, being in the beginning of the Fever so much obstructed ; it is simply impossible for such Medicaments to carry these Obstructions off as they are just now ; they must rather force through the superficial *Arteries*, and those few other *Glands*, that are (perhaps) left passable, the natural Humidity only, *i. e.* the thinnest Parts of the Blood, and consequently make it more viscid, and thereby the Obstruction more firm, *i. e.* will increase the Fever ; whereas, when a great deal of these Obstructions in the *Arteries* are washed away by the Force of the Blood ; *i. e.* in or near the Decline of these Fevers, such Medicaments will be able to force the small Remainder of these Obstructions, either through the Orifice of the *Gland*, or into the continued *Vein*, 'till, by frequent Circulations, it be either lost, or thrown out of the Body.

FROM all that has hitherto been said about the Cure of these Fevers, it is evident,



## C O R O L L A R I A.

1. **T**HAT the first Thing incumbent upon a Physician, in the Case of these Fevers, is to let a considerable Quantity of Blood, both in order to remove the Cause of these Fevers, and to prevent the Inconveniences of the subsequent Vomitting. *Bellini*, in *Prop. 5. and 6. De Febris*, has demonstrated, that “*Vena in omni morbo*  
 “*est secanda, in qua minuenda quantitas, aut*  
 “*augenda velocitas, aut refrigerandum aut*  
 “*humectandum, aut aliquid adhærens vasis*  
 “*dimovendum aut abripiendum.*” Than which there could be nothing more pat to our Theory.

2. THE second step in the Cure of these Fevers is Vomitting; for it at least removes the Obstructions of the Stomach and *Intestines*, and goes a great Length to take away the Obstructions of the other *Glands* likewise. This especially obtains in Fevers occasioned by Intemperance or Cold: As is evident from what we have said about Vomitting; but as for Purging in Fevers, there is very little more safe than what is the necessary Concomitant of all such Vomittings.

3. THE



3. THE last, but most universal, and surest Step, is the increasing the less sensible Evacuations: But this must be used only in the decline of these Fevers, as has been just now shewn.

I have in this Place only determined the Order, and the several Degrees of the Efficacy of these Remedies (in the Cure of Fevers) with respect to one another: Their Kinds and Quantities being to be adjusted by a former Analogy, I have given, when I was speaking about the Advantages of Vomitting.

BUT here it may be very fairly asked, why (since I make the Obstructions of the *Artery* and *Nerve* which constitute the *Glands*, the principal Cause of Fevers) do not I allow Mercurial Medicines (which all grant to be one of the most proper, and perhaps *Specific* Remedies of Obstructions) to be one of the Steps of the Cure of these Fevers?

BEFORE I answer this Question, I shall, 1. Explain the Nature of Mercury. 2. I shall shew the Manner of the Operation of these Medicines; and, 3. The Advantages and Usefulness of them.



I. *As to the first I suppose,*

I. THAT pure Mercury, or Quicksilver, consists of Parts (I mean those of the first Composition, by which I understand an Aggregate of the smallest and least constituent Particles of any Body, and an Aggregate of these Aggregates I call of the second Composition ; and so on) exceedingly small, equal, and perfectly spherical.

THIS has been supposed by all who have written any thing tolerable about the Nature of this Mineral. It is true indeed, some have supposed it so, because they saw that dividing Mercury upon a plain (even by the Assistance of a Microscope) still the upper Part retained its Sphericity, which they could not so easily observe in other Fluids : But the true Reason of this is, The great Gravity of the Mercury, in respect of other Fluids, and the uniform Pressure of the Medium. For all Fluids will retain their Sphericity till their Quantity be so diminished (either by there being another Heterogeneous specifically lighter Body included in them, or by their Gravity decreasing at a greater rate than their Surfaces) that they are of equal Gravity with the unequal Portion of the Medium they are in, and then



then they will receive any Figure the Motion of the Medium can imprint on them. However the Divisions of Mercury must be very small, before it can be reduced to this State; but that it can at last be brought to it, is evident from the mixing and pounding of Quicksilver among common Water in which we know a Part of the Quicksilver is lost, by the Diminution of its Weight, and the discolouring and effects of this Water.

BUT the true Reason why the former Supposition is to be made, is, because from it some of the Phænomena of Mercury may be accounted for.

FOR, from thence it is evident, why Mercury (though the heaviest known Fluid) rises with fewer Degrees of Heat in an Alembic, than any other. 1. Its Parts (of the first Composition) being exceedingly small, *i. e.* smaller than such parts of any other Fluid, it must rise sooner than they; because the Gravity of its Particles has a lesser Proportion to their Surfaces, than the Gravity of the Particles of any other Fluid has to their Surfaces; for the Gravities of Bodies decrease in a Triplicate Proportion, whereas their Surfaces decrease only in a Duplicate one. Thus supposing (for Example)

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ple) the Diameter of a Particle of Mercury (of the first Composition) to be to the Diameter of a Particle of Water (of the same Composition) as 2 to 300; (and we may justly suppose the Odds infinitely greater) their Surfaces will be as 4 to 90000. And their Solidities, *i. e.* their Gravities, as 8 to 27000000. This upon Supposition their Specific Gravities were equal; but supposing (at the largest) the Specific Gravity of Mercury to that of Water, at 15 to 1. The real Gravities of such Particles will be to one another, as 120 to 27000000: Whence it is evident, that not only the *Ratio* of 8 to 4, or 2 to 1, is much less than that of 27000000 to 90000 or 300 to 1. And therefore upon such Supposition it will follow, That the Gravities of such Particles of Mercury, would be much less than that of such Particles of Water: And that the Surfaces of these Particles of Mercury, would be much larger, in Respect of their Gravities; than that of the like Particles of Water, in Respect of their Gravities; and consequently the Mercury would rise in the Alembic with much fewer Degrees of Heat, than the Water upon this Account. But, 2. The Particles of Mercury are perfectly Spherical and Equal; (for all Homogeneous Bodies must consist of Particles *Similes & æquales* in the *Euclidean Sense*,  
*Vide*



*Vide Def. 1, 6, & 9. 11. Euclid*) and consequently can only touch in Points, and thereby their Sublimation will become more easy. A Sphere can be touched but by 12 other equal Spheres, and that too, but in so many Points; and if we suppose the superficial Particles of the Mercury to be first raised in the Alembic, they can be touched only by 9 other. Now the Force and Value of such a Contact as this of 9 Points, is less (*cæteris paribus*) than that of other solid Bodies generated by the Circumrotation of whatever Figure, Regular or Irregular, Right-lined or Curve-lined: For the Contacts of Circles is the measure of the Contacts of all other Figures whatsoever; and though in some Curves their Contacts in some Points, may be less than that of Circles (*vide Scholium Lem. 11. Princip. Phil. Mathem. Newtoni*); yet in all their other Points, they will be proportionally greater, and consequently the Value of the whole Contacts greater than that of Circles; wherefore it is evident, that Spherical Bodies will be more easily separated than any other, and consequently will rise in the Alembic with fewer Degrees of Heat than any other. *I suppose,*

2dly. THAT the only Effect of the Sublimations, and other Preparations of Mercury,



cury, is the dividing it into these Parts of the first Composition, which are Spherical, *per Suppos.* 1. or into parts of a more complicated Composition, which (by reason of the vast Gravity of Mercury, in respect of other Fluids, and the uniform pressure of the *Medium*) may be still Spherical: For if the Mercury be pure, and no Heterogeneous lighter Body be mixed with it, it will still retain its Sphericity, till the *Ratio* of the Surface of a Particle of Mercury to its Gravity, be to the *Ratio* of the Surface of a Particle of Air to its Gravity, as is the Specific Gravity of the Air, *i. e.* (putting the Specific Gravity of Mercury to that of Air, as  $m$  to  $n$ ; and the Diameter of a Particle of Mercury  $x$ , and that of a Particle of Air  $a$ .) till  $m : n :: \frac{1}{x} : \frac{1}{a}$ ; the  $x$  will be equal

to  $\frac{na}{m}$  that is, (supposing  $a$  equal to Unity

as the Standard  $m$  to  $n$  as 10800 to 1 *proximè*, as all know) the Diameter of a Particle of Mercury must be 10800 Times less than that of a Particle of Air, or the Particles of Mercury themselves, 1259712000000 Times less than these of Air, before they lose their Sphericity. Now besides these Divisions into Spherical Particles, the Saline Bodies which are mixed with the Mercury in



in these Preparations keep these asunder and disjoined; like so many congealed little Bullets separated by the Fixation of some Liquor. This is (as I suppose) the whole effect of these Preparations; as is evident from what Mr *Boyle* and all other *Chemists* have found; to wit, that from all the Transmutations and Preparations of Mercury, they could elicit the same uniform heavy Fluid; which could never happen if there were any other (besides the now mentioned) effect produced by these Preparations: For by what means soever you dissolve this congealed Separation, the greater Gravity of Mercury brings its Particles into their former Union, and thereby reduces them into the same fluid Quicksilver. Besides these two Suppositions, it is to be observed,

I. THAT the chief Ingredients in Mercurial Preparations are (besides it self) common and Armoniac Salts, and their Spirits, the Spirit and Oil of *Nitre*, *Vitriol* and its Spirit, and the like (which afterward we shall call by the General Name of *Saline Bodies*). All which (we know) are endued with a vast Power, to vellicate and stimulate the more sensible Parts of Animal Bodies, and (consequently) to produce Vomittings and Purging (of themselves) according to their



their Quantity, and the Degrees of their natural Force.

2. THAT the only Effect of repeated Sublimations in these Preparations, is, the Division of the Mercury into smaller Particles, and the freeing of these from the grosser and more noxious Parts of these *Saline Bodies*; for Mercury, sublimating more quickly and easily than these other *Saline Bodies*, must, in repeated Sublimations, have a greater Proportion to the *Saline Mixture*, than in the first Sublimations, and consequently the subsequent Sublimations must have less of those *Saline Bodies*, than the *antecedent*, whereby the Preparation will become sweeter and less vellicating. This is evident from *Aquila alba* & *Panacea Mercurialis*, which are all much heavier (especially) than any other Preparations of Mercury.

THESE things premised, I come to explain,

II. THE Manner of the Operation of Mercurial Medicines; in performing which I distinguish two Cases. 1. Either the Medicine is taken inwardly. Or, 2. It is applied outwardly; under which Head I comprehend both Mercurial Inunctions and Plasterings. As to the 1. After the Medicine



cine is taken by the Mouth, it descends into the Stomach, and there the Saline Parts of the Composition vellicate the *Fibres* thereof, which occasion those Gripes felt upon the taking these Medicines: And if the Saline Particles have a considerable Share in the Composition, they so powerfully stimulate the *Fibres* of the Stomach, as to bring it into these Contractions, which produce Vomitting, as has been formerly explained: The Mercury itself, with some of the Remainder of the Saline Particles, slipping into the *Intestines*, do likewise vellicate these, and occasion a gentle Purge; which Effect, though it be constant (in the first Days after taking these Medicines) yet it is never so violent as that of other Purgatives; because most of its Force is spent in the Stomach. Now that both the Vomitting and Purging produced by these Medicines, are owing to the saline Parts of the Composition, is evident from the Nature of Mercury, and the Effect produced in it by the Chemical Preparations thereof just now explained: For Mercury consisting of Spherical Particles, and by such Preparations being only divided into these of themselves, (as being Spherical) these Particles could never occasion the Stimulations, which (as has been formerly shewn) are necessary to produce these Effects. The only thing they  
can



can contribute towards them is, that by their excessive Gravity and Smallness, they are capable to dissolve the Cohesion of the more viscous Fluids of the Stomach and *Intestines*, and consequently make them flow more easily, when the *Muscular Fibres* of these Parts are otherwise brought into Contractions. Besides, we see that the fore-mentioned Effects, are mostly produced by those Compositions, in which most of these *Saline Bodies* enter. As in the corrosive Sublimate, the white and yellow Precipitate: But in the others, which pass many Sublimations, (as the sweet Sublimate, and the *Panacea Mercurialis*) we judge of their Goodness as they produce least of these Effects. I ascribe the Sweating produced by a Dose of some of these Compositions, partly to the violence of the Vomitting, and partly to the Saline Particles which enter the Composition; and that small Salivation, to the immediate Action of these *Saline Bodies* upon the Salivary Glands, and not to the Mercury itself. All these will be evident to any who have seen the sudden Effects of these Medicines, which have not had sufficient time, neither to enter nor circulate with the Blood, so as to be able to produce the mentioned Sweating or Salivation after the ordinary Manner. Thus I have endeavoured to explain the Effects  
of



of these Medicines while they are in the *Primæ Viæ*. I shall now show the manner of their Operation in producing a *Flux de Bouche*, that thereby the lesser Effects of this Kind may be understood.

THE Mercury being freed (by the Action of the Stomach, and the Heat of the Liquors contained in the same and in the *Intestines*) of most of the saline Part of the Composition, enters the Blood by the Lacteals, and is, with it, carried about through the Canals where either it, or any Liquor (of the Body) generated by it, flows, (the small Remainder of these Saline Particles, which adheres to the Mercury after the Action of the Stomach and *Intestines*, assisting the Propagation of the Motion, by the vellicating the sides of the Canals) and having the same Celerity, but a much greater weight, it has consequently a greater Force and produces a stronger *Ictus*, and thereby (when once any considerable Quantity thereof has entered the Blood) it (by its great Force, and the smallness of its Particles) dissolves the unnatural Cohesions of all the Liquors, renders them more fluid and active, and likewise digs out all the Obstructions of the impassable Canals like so many little Bullets shot against a mud Wall, every little Bullet breaks down a Part till the whole be levelled ;



led ; and this it is the more able to perform, both because it is exceeding weighty, and makes therefore a greater and more forcible *Ictus*, and because its Particles are exceeding small, and are therefore to be considered as so many exceeding sharp Wedges or *Cunei*. Besides, by the smallness of its Particles it is able to enter into these slender Canals in which the Blood cannot freely pass, and thereby to scour all the Passages be they never so small. And that there are Canals, through which the Globules of the Blood cannot freely pass, we are convinced from Microscopical Experiments. Thus all the Liquors of the Body being attenuated, and consequently their Celerity and Force rendered greater, and all the Canals scoured, and rendered passable, the whole *Glands* of the Body are set at work, and throw out the more noxious and less fluid Parts of their Liquors, (by Reason the Particles of the Mercury either dissolve, or carry before them all the gross Particles which resist them) and thereby the Perspiration, Urine, Salivation, are increased, and the quantity of the Fluids lessened, and the whole Body emaciated, till there be nothing left but pure and useful Liquors, and clear and passable Canals. Those who can only be convinced by ocular Demonstration, may see a kind thereof in *Phil. Trans.* for Jan. 1700,



1700, where *Leeuwenhoek* from Microscopical *Experiments* on *Tad-poles*, confirms the main of this Doctrine, as to the Manner of the taking away Obstructions.

BUT there is another Effect of Mercurial Medicines, which is no ways to be forgotten; for besides these mentioned Effects, it destroys that corrosive Faculty of the Liquors, which bursts the superficial Vessels, and produces those constant Pains, Scabs, Ulcers, and the like, which we feel; For, supposing an Obstruction in any Vessel (either by the Corrosiveness or Viscidity of the Liquor, or from some extrinsick Cause) the Liquor stagnates and coagulates there, and by the Force of the fluent Part of that Liquor, and by the Corrosiveness of the stagnated Part, the Vessels are miserably distended, and their Parts dilacerated, which occasions constant Pain in that Part; or they burst, and the Liquor putrifying, occasions a Botch, Scab, or Ulcer, more or less dangerous and painful, as the Corrosiveness of the stagnated and putrifying Fluid is greater or lesser. Now, this corrosive Faculty must proceed from the pointedness of the Particles (perhaps these Particles may consist of four equilateral triangled Plains, for such have the greatest equal Degree of Acuteness on all their Points, which seems necessary to make them



them equable in their Actions, and homogeneous in their Natures) of the stagnated Fluid. Now, the Mercury will not only remove the Obstruction, and make the Vessel passable by its Weight, but likewise by the same will break off, and plain the Points and Angles of these Particles, and so render them harmless and innocent; for *Sublata causa*, &c.

BUT here it might be objected, that the grand Effect (as most People believe) of Mercurial Medicines is Salivation, and that really the Salivary *Glands* secrete more of their Fluids proportionally than any other *Glands* of the Body, which is contrary to the 5. *Prop.* about Secretion. To this I answer,

1. THAT that the principal Effect of Mercury, is the attenuating the Fluids, the clearing the Canals, and the destroying the Corrosiveness of the Obstructions, and that Salivation has no more Title to be the principal Effect of Mercury, than insensible Perspiration : For all the *Glands* (notwithstanding the Objection) secrete their respective Liquors in the Proportion mentioned in *Prop.* 5. about Secretion. 2. It is evident that Salivation is not the main Effect of Mercury, from this, That many Persons  
are



are cured of very dangerous Poxes, Ulcers, and Rheumatisms, without ever salivating, at least at the ordinary Rate of Salivation. But 3. The Reason why we seem to seern more by the salivary *Glands* proportionally, than by any or most others, are these,

1. The salivary *Glands* are more in Number than any of those which separate visible Fluids; and consequently it is but reasonable they should seern more than any other. It is true, the *Glands* of insensible Perspiration are more in Number than those; and it is not to be doubted, but they seern more likewise; and it will be found so whenever the Thing is examined after *Sanctorius's* Method; but that Secretion not being visible makes the Matter doubted.
2. The Canals which constitute the *Glands* of Salivation are evidently wider than these of others, as is clear from their spongy and soft Contexture; and so it is very accountable from their mentioned *Prop.* why they seern more plentifully.
3. The Fluid seerned in the Salivary *Glands* is ropy and viscid, and one Part draws forward another, which does not happen in most other *Glands*, and upon this Account it is no Wonder, that those seern more than these.
4. The Salivary *Glands*, in some People, have not so good a Contexture, and so obvious a Course, as

H in



in others: And this is the Reason, why some salivate little or none, and others too much. But 5. The true Account of the Matter is this, The *Saliva* being a tough ropy Substance, cannot be thrust out so fast, as the Mercury carries it forward, especially seeing it separates only the most glutinous Parts of this *Saliva*; whence all the salivary *Glands* begin to swell, until there be such a Quantity accumulated, as, together with the Force of the Mercury, and of the succeeding Fluid, is able to burst the Orifices of the *Glands*: And it is observable, the Salivation continues only so long, as any of the *Glands* are found swelled. Whence it is evident, that this plentiful Salivation depends upon this, That the Fluid is as it were laid up in Store, to be derived more plentifully afterward; whereas in the other *Glands* the Fluid being thinner, is secreted as fast as it is driven forward: And hence it comes to pass, that we think the *Saliva* secreted, is much greater in Quantity than what is derived from the other *Glands*. If we take in all these Considerations together, they will account for the plentiful Salivation by Mercury.

2. As to the second Case. In Mercurial Inunctions the viscid Matter, in which the Quicksilver is wrought and pounded, serves  
only



only to keep the small Particles thereof separated and afunder, and to apply them to the Skin, 'till by frequent rough Frictions the smallest Particles of the Mercury are forced through the Sides of the Cuticular *Arteries* into the Blood; and when once they are got thither, they are in the State juſt now mentioned, and operate after the Manner already explained. And indeed, this were the ſhorteſt and eaſieſt Courſe of raiſing a *Flux de Bouche*, if Mercury could be adjusted to the Strength and Conſtitution of the Patient, (for the Quantity of Mercury, which will kill one, will not produce the deſigned Effect of Salivation in another) by this Method, as exactly as by adminiſtring it gradually in Doſes, by the Mouth. But it cannot be done ſo, and therefore the latter Courſe is the more ſafe.

MERCURIAL Plaſters applied outwardly, to heal Scabs, or inveterate Ulcers, operate thus; The corroſive ſaline Mixture, if there be any Part thereof in the Compoſition, eats away and corrodes the putrid Matter, which ſeals up the Mouths of the Veſſels; ſo that the Mercurial Particles get eaſily into them, where they both clear the Veſſel of the Obſtructions, and deſtroy the Pointedneſs of the Particles of the Fluid,

H 2

which



which two things did concur to make the Ulcers fore. If there be no Saline Body in the Application, then the Mercury must be forced in by Friction, into the Mass of the Blood, to produce the designed Effect.

THUS, from a few easy and evident *Postulates*, I have given an intelligible Account of the Manner of the Operation, and of the Effects of Mercurial Medicines, when the Mercury enters in any Quantity into the Mass of the Blood, and from thence it will be easily understood, that when the Quantity is less, the Effects will be proportionally lesser; so that it will be needless to explain all the several Degrees thereof by Detail. But seeing it is evident, from *Leeuwenhoek's* Observations in the last mentioned *Phil. Trans.* that the Force of the Blood is able to wash away some Obstructions; let us take a gross Estimate of the Proportion of the Efficacy of the Blood assisted by Mercury, to the Efficacy of the Blood itself and unassisted, to take away Obstructions. First, then, we must consider, if instead of the ordinary Liquors there passed nothing but Mercury in the Canals of the Body; the Weight of Blood being to that of Mercury, as 1032 to 14593, or as 1 to 13 at least, and their Velocities being the same, Mercury would at least be 13 times more able



able to remove the Obstruction, than the Blood of itself: But it is certain (if the Obstruction renders the Canal impassable) there can no Particle of the Mercury get away; and (when there is any Quantity thereof got into the Blood) there are still some new Particles thereof coming up, so that after some Time (they having a greater *Momentum* than the *Globules* of the Blood, and thereby getting through it up to the Obstruction) we may consider, there will be little or nothing, save Mercurial Particles, at, or near, the Obstruction, driven against it, by the whole Force of the Blood; so that, as to the Obstruction itself, it is very near the same, as if the whole Canals run Mercury. However, let us take the Proportion only as 1 to 10; so that upon this Account the Blood, assisted by any considerable Quantity of Mercury, will be 10 times more able to remove the Obstruction than the Blood unassisted.

*Secondly*, Let us consider, the *Globules* of the Blood are Elastic (for they often lose their Figure in strait Canals, and recover it again, as *Leeuwenhoek* has shown, which is the Definition of Elasticity) and those of Mercury are not, or very little so: And consequently upon this Account, the Efficacy of the *Globules* of Blood will be



hugely diminished. Let us suppose it loses  $\frac{1}{2}$  of its Efficacy (which is a liberal Allowance) and then the Proportion will be  $\frac{3}{4}$  to 13, or 3 to 40.

*Thirdly*, Let us observe, That the *Globules* of the Blood, and Mercury driven against the Obstruction, and at every Pulse digging away a Part of the same, may be considered as *Cunei*. Now, *cæteris paribus*, the Force or Efficacy of *Cunei* is reciprocally proportional to the Angles their Edges make. But in Spheres, the lesser or greater Degree of Curvity is to be considered as these Angles, when these Spheres are considered as *Cunei*: And Degrees of Curvity in Spheres (as in Circles) are reciprocally as their *Radii*. Supposing then the Diameter or *Radius* of a Particle of Mercury is to that of a *Globule* of Blood, as 1 to 100 (and there can be Reasons given, some of which I have formerly hinted, why the Odds may be supposed much greater) then the Force of the Mercury, and the Blood, to that of the Blood unassisted, to remove Obstructions, will be as 4000 to 3. Lastly, let us consider, that by the Force of the Mercury, the Liquors of the Body are exceedingly attenuated, and rendered more moveable, and are thereby capacitated to receive a stronger Impression; so that they  
both



both move more quickly, and with greater Force, as is evident from the Pulse of those who are under a *Flux de Bouche*, whose Pulse is little less frequent and strong, than the Pulse of those in a Fever. Let us suppose the Proportion, both of the Frequency of the Pulse, and of its Strength to that of an ordinary one, as 3 to 2, (and this is certainly much less than the Truth) then it will be as 3 to 2, upon the Account of its greater Force; and again as 3 to 2, upon the Account of its greater Frequency, that is as 9 to 4. So that now upon this last, and all the former Accounts, the Proportion of the Efficacy of the Blood, assisted by any considerable Quantity of Mercury, to that of the Blood unassisted, to remove an Obstruction, will be as 36000 to 12, or as 3000 to 1. So that the first will be 3000 times more effectual for that End than the latter. But if any should still think we have made too liberal Allowances for the Mercury, let us rebate the Proportion one third Part; yet still the Blood, assisted by any considerable Quantity of Mercury, will be able to do as much toward the Removal of an Obstruction in one Day, as the Blood unassisted in three Years almost.

BESIDES, there are a great many Cases in which the Blood unassisted, is so far



from being able to remove the Obstruction, that it will continually increase the same: For if the Obstruction proceed from a Depravation of the Liquors of the Body, as in *Rheumatisms*, or if some corroding Matter, be forced into the Liquors, so as to be able to vitiate the same, as in Poxes, Pests, and Poisons, it is demonstrable, that (without some external Assistance, either by Diet or Medicines) the Malady, instead of mending by Length of Time, will increase. But if the Obstruction proceed from some external Injury, as in Bruises, Wounds, Colds, and (perhaps all continual) Fevers, the Liquors (still persisting in their natural and wholesome State,) may do much to drive away the same by Length of Time; but still the sooner, and more safely, if they be assisted by convenient Medicines. I come to,

### III. THE Advantage and Usefulness of Mercurial Medicines.

AND, I. They are useful for destroying the Viscidity and Thickness, the Corrosiveness and Pointedness, of the Particles of the whole Liquors of the Body, rendring them fluid and moveable, innocent and harmless, if before they were otherwise.

THEY



2. THEY are evidently useful for removing all Obstructions, Ulcers, Scabs, Botches, Swellings, constant Pains, (all which are but the Effects of some kind of Obstruction or other) of whatever Nature or kind, by adjusting only their Quantities rightly, but that is the Work of an able Physician.

Now, for answer to the Question which gave Occasion to this Discourse: Mercurial Medicines were exceedingly useful, and would answer the whole Design in curing Fevers, were it not upon these two Accounts. 1. Before they could be effectual for this Purpose, they ought to be administered in a large Quantity, which never misses (by the Violence and Force of the Motion of the Blood thereby occasioned) to induce a new Fever in a Patient, of it self; so that instead of curing the former Fever it would double it, and make the Danger double, which by no means is to be done; the Patient having enough to do to wrestle with one. But, 2. It requires so long time to bring the Effects of Mercurial Remedies to any Height, that the Patient (in so long a space) would be cured by the Force of Nature, or killed by the Violence of the Disease; so that upon this Account they are rendred useless. Besides there are  
a thou-



a thousand other Inconveniences which render this Method, in its full Force, altogether impracticable.

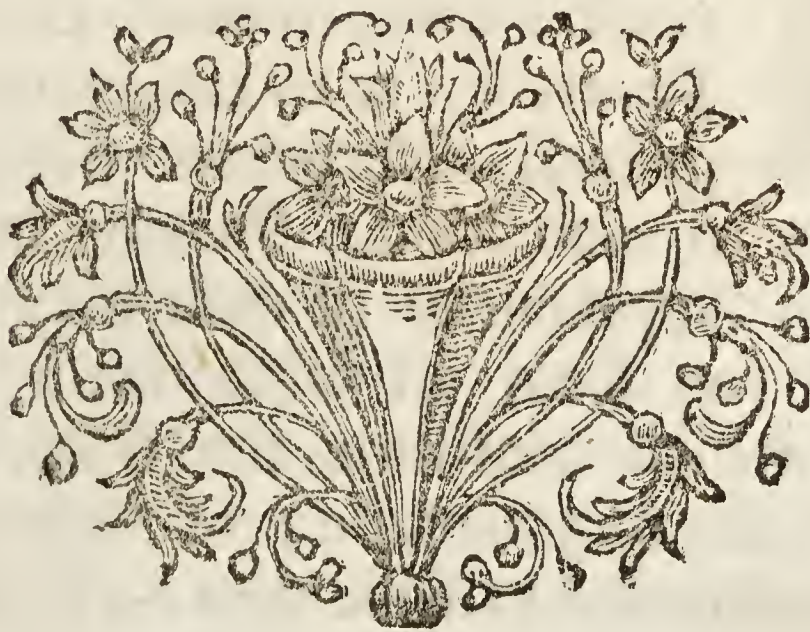
AFTER all, I remember to have been told (some time ago) by that Eminent Physician of our Country, (whom I have thrice already mentioned) that People who have been severely fluxed, seldom fall into dangerous Fevers; and that in Fevers of Children occasioned by Worms, Mercury, if discreetly us'd, is always (and in some Fevers of riper Years, is often) very successful. The Reason of both which is very evident from our Doctrine.

FOR, in those who have been severely fluxed, the Blood is so purified, and rendered so fluid, and all the Canals are so cleansed and scoured, that if at any time there should happen such Obstructions as occasion Fevers, Nature is able in a short time to drive them away, seeing they must rather happen from some external Cause, than from within, where all is clear and passable.

As for Fevers occasioned by Worms among the Fluids in the Bodies of young Persons (which by the way is an Argument omitted for our Theory of continual Fevers, as is likewise the *Febris Variolarum*, both which



which are occasioned by Obstructions, as is evident from the Botches which break out upon the latter, and as shall be just now shown of the former) : For here a little Worm being forced into some of the capillary *Arteries*, where it can neither get back nor forward, totally occludes the Passage of the Blood, and thereby occasions a Fever after the manner already explained. Now the Reason, why the natural Force of the Blood is not able to remove such an Obstruction is, because a living Creature makes it, which will not be mouldred away after the manner of coagulated Blood, but will require the greater Weight, and force the Mercury to kill it first, and then both the Mercury and Blood concurring, wash it away.





THE  
APPLICATION  
TO THE  
General Proposition  
TO  
HECTIC FEVERS.

**H**AVING in the former part of these Papers, treated Continued Fevers so, as to comprehend the general Symptoms which are common to each kind; shewing how the common Appearances of each may be accounted for, from an Obstruction of the Canals which constitute the *Glands*, and thereby an Augmentation of Quantity of the Blood in the passable ones; and how all the Changes of the Motion and the Qualities of the Blood necessary towards a true Theory



Theory of Hot Fevers, did naturally follow from thence ; so that the general Doctrine may easily be applied to all the Varieties of continued acute Fevers. I shall now endeavour to shew, how the Appearances of slow consumptive Fevers in general, and of *Hectic Fevers* in particular, may be deduced from the other part of the general Proposition ; viz. from a Dilatation of the Constituent Vessels of the *Glands* : In order to which, I premise the following

*Lemma III.*

*Cæteris paribus*, The Strength of different Animals of the same Species, or of the same Animal at different Times, are in a triplicate Proportion of the Quantities of the Mass of their Blood.

*Demonstration.*

IT is evident from the Animal Oeconomy, that the Augmentation or Increase not only of all the Fluids, but likewise of all the solid Parts of the Body, is owing to the Blood, and that the same (all other things being equal) is proportional to the Quantity thereof ; and it is certain from infallible Experiments, that (whatever be the Cause of Muscular Motion) the Blood it  
self,



self, the *Liquidum Nervorum*, and the Muscles, (*i. e.* a bundle of Muscular Fibres, and the Integrity of the same) are only and absolutely necessary to the Action of the said Muscles; for, put any two of these, and entirely take away the third, no Motion will follow: Wherefore the Forces of any one, or of all the Voluntary Muscles, *i. e.* the strengths of Animals, are in a compound Proportion of all these three. But the Quantity of each of these three, in this case depends upon, and is in Proportion to, the Quantity of the mass of the Blood, as has been just now shewn: And therefore the Strengths of different Animals of the same Species, or &c. *q. e. d.*

*Scholium.*

IT is not so easy to compare the strengths of different Animals of the same Species, as to compare the Strengths of the said Animals at different Times; for in the first case, before the foresaid *Lemma* can obtain, it is necessary they be of the same Age, Stature, Disposition, and Constitution, all which Conditions are hardly found or made evident to be so: But in the latter it is necessary only, that the Animal gently and insensibly increase or decay, as in the same Animal, Young and Old, and betwixt the two.



two. But whether in the same, or different Animals, if these Conditions were equal, it were easy to determine the Proportion of their Strengths; for then, opening the same Vein or Artery in both, making (as near as may be) the same Orifice and Ligature in the same Place of the Vein or Artery; observe the Quantities of Blood emitted at the same Time. The whole of the masses of their Blood shall be as the Quantities emitted, and consequently their Strengths in a Triplicate Proportion of these.

*Corollary.*

HENCE the Reason is evident of the Disproportion of the Strengths of the same Person, a Boy, and old Man, in the mean betwixt the two, and in a Fever, although the Odds betwixt the Quantities of his Blood, at these different Seasons, be not so great; for, let the Quantities of his Blood, in the same Order I have named them, to be 10, 15, 20, 30 Pounds, *i. e.* their Proportions, 2, 3, 4, 6, his Strength shall be in these Proportions, 8, 27, 64, 216; how this Proportion somewhat abated, serves to account for the Weakness of Hectic People, shall be afterward shewn.

*Pro-*



*Proposition.*

THE general and most effectual Cause of Hectic Fevers, is a Dilatation of the constituent Vessels of *Glands*, (or to express it more universally, as it may be done in the other particular Proposition) of the Conduits of Secretion.

SUPPOSING a Dilatation of the Conduits of Secretion, it will follow, as a Corollary, that the Quantity of all the Fluids of the Body may be supposed thereby diminished, in any given Proportion of Minority to the whole of these : For, from the said Dilatation supposed, there will follow a greater Velocity of the Fluids contained in the Canals of the Body, as shall be afterward demonstrated : And since, by the 5th Proposition about Secretion, the Quantity separated is in a compounded Proportion of the Velocity of the Fluid, and of the Orifice ; both these being augmented, the Quantity of the Separation must be proportionally augmented, and consequently, the Quantity of the remaining Fluids proportionally diminished ; so that merely upon this Account, when a Person falls into a *Hectic* Fever, we may suppose the Quantity of his Blood (because it is from the rest of the Fluids,



Fluids, which we are speaking of, generated) to be considerably abated: Let us suppose him from 20 Pounds in his ordinary State, to have dwindled into 16; then, by

*Lemma Primum*, and its *Scholium*  $\frac{a a}{a+6} =$

12 Pounds, in case of a Subduple Dilatation; and  $\frac{a a}{a+6} = 12 \frac{4}{5}$  Pounds, in case of

a Subtriple one, *i. e.* if there be (upon the aforefaid Account) supposed but 16 Pounds of Blood in a Hectic Person, as the *Media Quantitas*, and that to the Cylindrical Canals (equal to the whole Vessels of the Body, save the Intestines and Lacteals) there be added another, whose Orifice is equal to one half of the former, (*i. e.* if the Vessels be dilated in their Orifices one half) then the Quantity of 16 Pounds of Blood in these so dilated Vessels, shall be but like 12 Pounds in these Vessels, if they had not been dilated, and produce but such Effects, as such a Quantity would do in the Canals, if they were in their ordinary State; and so in other Dilatations. From both these Considerations it is clear, we may suppose the Quantity in all Fluids of Hectic People abated at any required Rate of Minority.



COME we now to solve the Appearances of Hectic Fevers. From the Dilatation of the Conduits of Secretion, and the Diminution of the Quantity of all the Fluids, and of the Blood especially, it follows :

§. I. THAT the Velocity of the Blood will be greater, and consequently the Pulse more frequent and quicker. The taking away an *Impedimentum* from one Side, is equivalent to (the Circumstances continuing the same as formerly) the adding an equal *Momentum* on the other : Wherefore, if I shew, that the *Impedimenta* to the Motion of the Blood, are (by these) taken away, it must follow, that the Motion and Velocity thereof must be augmented. This I shall do in these three Particulars, 1. It is certain that one great Resistance to the Motion of the Blood, at the Heart, or in the Arteries, is the precedent Blood in the Arteries, continued through the Veins to the Heart and Arteries again ; for the preceding Blood always hinders the succeeding, seeing before the one succeed in its Place, the other must be removed : And this Resistance is always proportional to the Quantity of the Mass of the whole Blood ; but the Quantity of the Blood being diminished, this *Impedimentum* must be proportionally diminished, and consequently the Velocity of the rest, greater.



greater. This we evidently perceive in the Time of Blood-letting. 2. Another principal Resistance of the Motion of the Blood, is the striking of the Particles of the same against the Sides of these Vessels, especially Conical ones; now the Dilatation of these Vessels will much lessen this Resistance, upon these three Accounts. 1. The Vessels being dilated, the Cylinder, whose Base is the perpendicular Section through the Axe of the narrowest Passage of the Canal, will thereby be augmented, and consequently many more Particles, than otherwise, get free, without striking against the Sides of Canals. 2. Those who do not strike, are removed to a greater Distance from the Sides of the Canal; *i. e.* their Motion is quicker; for, in this Case, the Sides of the Vessel are as *Fulcra*, and the greater Distances as longer *Veſtes*, and consequently the Celerity as these *Veſtes*. 3. The Surfaces of little Things have a greater Proportion to their Bulks or Solidities, than those of greater Things to theirs; and therefore the internal Surface of a smaller Vessel, will be greater in respect of its contained Fluid, than those of a greater Vessel in respect of its, and consequently against the internal Surface of this dilated Canal, fewer Particles of the Blood will strike, than against the same when it was narrower. III. A



third Resistance to the Blood, is the Pressure of the circumambient Muscles, Bones, Tendons, and distended Canals, which do surround the Arteries (many of them) on every Side, and drive the Sides thereof inward: Now this is entirely taken away, by the Emaciation and Consumption of these solid Parts, which always precede Hectic Fevers. And, IV. Besides all these, the Velocity of the Blood must be increased; because (as shall be just now shewn) it is dryer, hotter, and more saltish than ordinary, and consequently it will (by the stimulating Quality following upon these) bring the Heart into more frequent Contractions, and increase the Propagation of the Blood in the Arteries. Now from all these, it being evident, that the Velocity of the Blood is greater, it follows: 1. That the Pulse must be more frequent; for the Heart being an involuntary Muscle, its constant Motion must, and does, depend upon the Influx of the *Liquidum Nervorum*, forced into it by the Arteries running upon the Nerves in the Brain; every beating of the Artery, forcing the *Liquidum* into the Muscle of the Heart, whereby it contracts, and the Velocity of the Blood being greater, this Influx must be more frequent; *i. e.* The Heart must contract oftner, and the Arteries likewise; for the Contraction of the Heart, and the Fre-



Frequency of the Pulse, is always proportional to the Velocity of the Blood. 2. It must be quicker, because by the great Velocity of the Blood, it stays but a short Time in the Expulsions of the Artery outward; *i. e.* it does not continue any long Time forcing the Artery against the applied Fingers.

§. 2. THOUGH the Pulse be frequent and quick, yet it must be weak; this is evident upon these two Accounts. 1. The Quantity of the Blood being small, the Arteries not being distended therewith, cannot be driven so far outwardly as ordinarily; and the *Ictus* of all unbending springy Bodies, *cæteris paribus*, being proportional to the Degrees of their being bended, the Arteries by this Defect of Blood being less bended or contracted than ordinary, must strike more weakly against the applied Fingers. 2. The Arteries not being so much bended as ordinarily, must likewise strike forcibly upon the Nerves running by them, and therefore a less Quantity of the *Liquidum Nervorum* will be forced into the Heart, and consequently the Heart contract less forcibly: *i. e.* the Pulses must be left weaker.

§. 3. THE Blood must be dryer, more gross, and more saltish, than ordinary; for



the Canals being wider, *ex Hypothefi*, and the Velocity of the Blood greater *per* § 1. the Evacuations must be proportionally greater *per Prop. 5 de Secretione*, and seeing, *per ejusdem* 3. the Parts of least Cohesion and greatest Fluidity, *i. e.* the thinnest, most humid and aqueous Parts, are first secerned, and most easily; therefore the dryer and groffer Parts will be last secerned; *i. e.* the remaining quantity of the Blood will be dryer or less humid, groffer or less thin, and consequently less saltish.

§. 4. THERE must be felt somewhat a greater Heat than ordinary, especially about the Arteries and Hypochondres. There must be a greater Heat than ordinary, felt over the whole Body, for these Reasons: 1. The Blood has greater room in the Canals, (they being supposed dilated) and consequently the Heat will have more Liberty, and not be so much pent up as ordinarily; and therefore it must break out more plentifully from the Particles of the Blood communicated by the greater Velocity thereof. 2. Supposing no greater Heat than ordinary in the Body, yet it will be felt greater because (the Conduits of Secretion being dilated) the Heat which is in the Body has a freer Egrefs outward, and must stream out more abundantly upon any Thing which touches the



the Skin of the Hectic Person. 3. The Blood is more dry and saltish than ordinary, *per* §. 3. and therefore, upon this Account, there will be felt a greater Heat. This Heat is greater about the Arteries, because the Celerity of the Blood there being greatest, must there most plentifully disentangle the Heat from the Particles of the Blood wherein it is lodged, and greatest in the right *Hypochondre*, because there most of the Liver is situated (which is the Laboratory of the Bile) which secerning commonly a hot saline Fluid must be much more so now ; likewise betwixt both *Hypochondres*, are the *Spleen* and *Pancreas* placed, in which, on this Occasion, a more than ordinary Heat may many Ways happen. This Heat, whether universal or particular, is scarcely ever felt by the Patient, both because it is a great deal more moderate than that of acute continued Fevers, and because a long Habit and Custom has made it insensible, as they do in all other Things.

§. 5. THE Reason of the Increase of the Frequency of the Pulse, and of the Heat after eating is easy from these Reasons. 1. Because there is a greater Plenty of the *Liquidum Nervorum* generated, which will make the Heart contract more frequently ; *i. e.* will make the Pulses quicker : And, 2.



Because the Chyle entring into the Mass of the Blood, will be immediately (because of the Velocity of the Blood) divided into minute Parts, and the Heat thereby disengaged *i. e.* the Body will be hotter *per* §. 4. And both these Effects will continue as long as any of the Effects of the Repast remains.

§. 6. THE vast Decrease of Strength is evident from *Lemma* 3. It is true indeed, the Increase of the Velocity of the Blood, demonstrated §. 1. will somewhat abate the Proportion there given; but we must consider, though the Celerity of it be considerably great, yet the Quantity thrown into any determined Part of the Body at one Contraction of the Heart (which is all that is here useful) is very small: Besides, there is a great Difference betwixt the Motion of the voluntary Muscles (which is the proper Estimate of Strength) and that of the involuntary ones, such as the Heart; for the Pulse may be very quick, from such Reasons as I have shewn, §. 1. and yet the Patient very weak; so that from these it is clear, that there is no great Occasion for abating any Thing of the aforesaid Proposition; however, giving as much as may be required, still there is sufficient in this *Lemma* to satisfy this Appearance.



§. 7. FROM this Decrease of Strength, *i. e.* Weakness, it is clear, why Persons labouring under a Hectic Fever, are unwieldy, unactive, and, as it were, sluggish.

§. 8. THE Urine of Hectic People has the ordinary Colour, but it is greater in Quantity in Proportion to their drinking, *per 3 and 4 Prop. de Secret.*

§. 9. LASTLY, It is evident from what has been said, that if these Symptoms be not removed, they will necessarily increase, even into those Heights, which they call the Second and Third Degrees of these Fevers, till they end in an entire Extenuation and inevitable Death. This needs no Proof.

I. THUS, from the Supposition, of a Dilatation of the Conduits of Secretion, I have accounted for all the Appearances of this Kind of Fevers, which is one Argument for the Verity of our Doctrine.

II. FROM the same supposed Dilatation, I have shewn how the Blood will necessarily become hotter and drier, which are all  
the



the *Data Bellini* requires to account for these Fevers, which is another Argument.

III. THE Antecedents of Hectic Fevers, such as are violent Evacuations by Urine, Stool, or Sweat, &c. *Ulcers* in the *Throat*, *Lungs*, *Kidnies*, *Womb*, &c. A hot and dry Disposition, precedent long-continued acute Fevers, Drunkenness, Madness, &c. In short, every thing that consumes the Humidity of the fluid or solid Parts; I say, all these produce a Dilatation of the Vessels these two Ways. 1. They spend and consume the solid Parts, by withdrawing their Humidity, so that these shrink in and contract, and consequently do not press so much upon the surrounded Canals, and thereby they have Freedom to be dilated, as far as the Force of the contained Fluids can distract them, or as they naturally of themselves will unbend; for the Canals are forcibly contracted, (by the Muscle of the Heart and their own Muscular Fibres) but naturally and of themselves, they widen and unbend. Now, though the violent Evacuation be but in one particular Place of the Body, yet by the *Æquilibrium* which is kept in the internal Fluids of the Body, as well as the external ones, all the others will suffer by it; for all, or most of the Fluids of the Body will be drawn



drawn toward that Place, till the consuming Part be brought into an equal Condition (as to Augmentations or Nourishment, over and above what is violently expended) with the rest, and therefore all the Parts will consume equally. 2. The solid surrounding Parts thus giving way, the Canals will naturally unbend themselves, and will be assisted thereto, by the force of the Fluids therein contained: And generally we observe Night-Sweatings immediately to precede such Fevers, which effectually opens most of the Conduits. Thus both these Ways the Conduits of Secretion are dilated, by the Antecedents of Hectic Fevers, which is not an Argument for, but a Demonstration of the Verity of our Theory.

4. A FOURTH Argument, is from the general Principle and Foundation of the Cure of such Fevers, (for taking first away the Occasion of the Distemper if they be symptomatical, that nothing may remain but the simple Hectic) they are always cured by such things (which being easily digested, and suited to the Weakness of the Stomach of the Patient, made so by this Malady) as do most augment the solid Parts, and consequently straiten and contract the Canals again.

5. LASTLY,



5. LASTLY, The Appearances upon the opening of such Persons as are cut off by Hectics do evidently confirm our Doctrine; for besides other things (as Ulcers, Gangrenes, and the like) we still observe large lank Canals, big Vessels, slender Muscles, and little Blood.

MUCH more might be added on this Head, but these are sufficient, else twice so much will not suffice.



*A General*



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*A General Method for examining the Quantity of the Augmentation, or Diminution, of the Mass of Blood, arising from an Obstruction or Dilatation of the Conduits of Secretion.*

**F**OR avoiding Confusion in the following Calculation and Discourse, I shall only name the Effects of an Obstruction, because any one, who pleases, may easily, with the Help of the immediately preceding Part of these Papers, apply the same Method of Reasoning, *mutatis mutandis*, to a Dilatation of these Conduits, the first being contrary almost in every Thing (here especially mentioned) to the latter.

THAT all continued acute Fevers are produced by the Obstruction of the Conduits



duits of Secretion, is so very evident, that none who observes, that any long continued Retention of these Things, which are usually, and in an healthful State, ejected out of the Body, (which is infallibly occasioned by an Obstruction of these Passages through which they ought to come) never misses to produce a Fever, more or less violent, can be ignorant of the same. Now the primary and immediate Effect of such Obstructions, is the Augmentation of the Mass of the Blood; because every thing ejected out of the Body (the Fæces only excepted) is derived from the Blood, therefore the Quantity of the Blood will be augmented, by so much as is the Quantity of that which ought to be ejected. These Obstructions augment the quantity of the Mass of the Blood, these two ways. 1. By keeping within the Body those Parts of the Blood, which naturally are ejected: Suppose the Passages of Perspiration and Urine were obstructed for one Day, in which a Man should take his ordinary Refection, certainly the Mass of the Blood would be augmented, by so much as is the Sum of the Quantities, commonly evacuated by Perspiration and Urine one Day, and that too by such a Quantity of Things, of such an ill Quality as Nature does not think them fit to be lodged in the Body of an  
healthful



healthful Person. If one should take his ordinary Quantity of Meat and Drink for some Days, and these Obstructions continue, the Mass of the Blood would be increased by such a Quantity of vicious Matter, as is the Sum of both these daily Evacuations multiplied into the Number of Days the Obstruction continues. But let us suppose, that the first Day's retention of this vicious Matter, does somewhat indispose the Patient, so that he will not be able to eat or drink so much the next Day; let this next Day's Repast have any given Proportion to, or be different from, the former Day's Repast, by any given Quantity, and let these Obstructions, and this *Ratio*, or Difference, continue for any Number of Days, the Mass of Blood will be augmented by a vast Quantity of vicious Matter: How to find the Sum thereof, I shall presently shew. It is true indeed, Nature (by the *Æquilibrium* generally kept in the Fluids of the Body) has wisely provided that the Diminution or Suppression of one Evacuation, should be the Augmentation of another, else we could not continue well one Day to an end: But it is likewise true, that this is not always so, at least not entirely; which is sufficient to our Purpose, and, therefore, whenever this Case happens, it must infallibly augment the Mass of the Blood.

But



But, 2. not only is the Blood by this Retention augmented, but a great many of the ordinary Passages being obstructed, occasions the Blood only to flow in the passable ones; whereby it is so accumulated there, as to augment the quantity thereof, in the passable ones to a huge degree. But having already in the first *Lemma*, and its *Scholium*, sufficiently considered the Augmentation arising from this Consideration, I shall now shew how to calculate the Increase arising from the former.

1. LET  $r$  to  $s$  represent the *Ratio* of an ordinary Man's eating and drinking in one day, to his Evacuations more or fewer in the same; let  $a$  represent the ordinary Quantity a Man eats and drinks in one Day,  $x$  the difference of his eating and drinking one day from another, upon the occasion of an Indisposition arising from any Obstruction, or Retention, of the usual Evacuations; and let this difference be constant for some days,  $y$  the number of days in which he takes any Refection at all; then the quantity of vicious Matter, by which the Mass of the Blood is augmented, shall be

$$= \frac{2 a s y + s x y - s x y^2}{2 r}$$

2. IF from the Difference of his daily eating and drinking given, you would desire



desire the Number of days in which this Retention should amount to any given Quantity; suppose  $c$ , then you may have it from the Solution of this Æquation

$$y^2 = \frac{x + 2a}{x} \quad y \frac{2cr}{sx}, \text{ wherein } x \text{ is gi-}$$

ven from  $y$ , and  $y$  from  $x$ .

3. SUPPOSING the same Quantities continue as they are, only with this Difference, that a Man eat nor drink less every day at a certain Rate, and not in a given Difference, *i. e.* the decrease of his Refection being formerly in an Arithmetic Progression, let it be now in a Geometric one, let the *Ratio* of this last Pro-

gression be  $m$  to  $n$ , or  $\frac{m}{n} = x$ ; Then the

Quantity of vitious Matter, by which the Blood is augmented in this Case, is

$$y + 1 = \frac{a^2 s x - a^2 s x}{a r x - a r x} y; \text{ where } y \text{ or}$$

$y + 1$  is the Exponent of  $x$ .

4. IF you desire this Quantity to be equal to  $c$ , as in the former Case, then the Solution of this Æquation  $Xy =$   
 $K \qquad \qquad \qquad a d r$



$\frac{a \, dr}{a \, dr + a^2 \, s} \cdot X \, y - 1 \frac{a^2 \, s}{a \, dr + a^2 \, s}$ , will  
 will give  $x$  or  $y$  from either of them sup-  
 posed known: If you desire  $x$  from  $y$   
 given, you must solve an *Æ*quation de-  
 nominated by  $y$ ; if from  $x$  given, you  
 want  $y$ , you shall have it by a Table of  
 Logarithms; for, put  $l$  to signify the  
 Logarithm of any Quantity,  $Y = l \, x \, l$ ,  
 $\frac{a \, ds \, x}{a^2 \, s \, x - a \, dr \, x}$ , that is the one Lo-  
 garithm divided by the other

5. IF you would have the full Effects  
 of these Augmentations, you must add  
 these found out in the first and third  
 Steps to the natural mean Quantity of  
 the Blood, *viz.* 20 Pounds, and then  
 apply the *Æ*quation found out in the  
 first *Lemma*; calling the Sum of both  
 these Quantities  $a$ . Thus let the 20  
 Pounds of Blood ordinarily found in a  
 Man, together with the Augmentations  
 (found in the first and third Steps) by  
 Reason of the Retention of the ordinary  
 Evacuations be called  $a$ , then, *per Lem-*  
*ma* 1, the true value of the whole  
 Mass of the Blood, in respect of the  
 passable



passable Canals, shall be  $= \frac{a^2}{a - b}$ .

6. If you desire this Quantity should be equal to a given one  $c$ , then  $b = \frac{aa - ac}{c}$ , and  $a - b = \frac{a^2}{c}$ , which are all the possible Varieties of these Cases. The same, with the greatest Ease imaginable, may be applied to a Dilatation.





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*The Application to the general  
Calculations of some particular  
Cases.*

**W**E all know, that in a continued hot Fever, the Perspiration is almost or altogether suppressed not only some time before, but very often, during the whole time of its Period. And *Sanctorius* in the 6th Aphorism of his 1st Sect. says, That if the meat or drink taken in one day ; amount to 8 Pounds, the insensible Perspiration, will be 5 Pounds: Hence the Proportion of the daily Repast to the Perspiration, is as 8 to 5, and the Quantity taken by the Mouth is 8 Pounds. Let us suppose he takes 6 Pounds of meat and drink the next day, the third 4 Pounds, and the fourth 2, and on the fifth he falls sick of a Fever, then by the first Step of the general Calculation, the Mass of the Blood will be augmented by



12  $\frac{1}{2}$ , Pounds of vitious Matter; and if in the Second Step of the same, we put  $c=12 \frac{1}{2}$ , then is  $y=4$ ,  $x=2$ . But if we suppose the daily Repast to decrease in a Geometrical Proportion, as 2 to 1, continuing the rest of the *Data* the same as formerly, by the third Step of the same, the Blood will be augmented by 10 Pounds; and if in the fourth Step we put  $c=10$ , then will be  $x=2$ ,  $y=4$ . Likewise, if we join these last 10 Pounds of Augmentation, to the ordinary Quantity of Blood found in a Man, then they will make up 30 Pounds; and if we suppose a Subduple Dilatation of the Vessels, then the true Value of the Quantity of the Blood, in respect of the passable Canals, shall be 45 Pounds; if a Subtriple, 40 Pounds; if but a Subdecuple, then the Mass of the Blood will be at least 33 Pounds, by the 5th Step of the general Calculation: And if, in the last Step, we put  $c=4$ , then shall be  $6=7 \frac{1}{2}$ ,  $a-6=22 \frac{1}{2}$ .

FROM all these Calculations, it is evident, that if the Augmentation of the Quantity of the Mass of the Blood, to any assignable Quantity, can produce a Fever, here it may had; for if a Man



naturally eats and drinks but little, or if but a small Part of the Perspiration be obstructed, yet still the Augmentation of the Blood may amount to the assignable Quantity if we put but lesser Quantities for  $x$ , and greater for  $y$ , *i. e.* The difference of his daily Repasts shall be less, or the Time, e'er he falls sick, longer.

2. IF the Urine be suppressed, either by a Stone, Ulcer, or Carbuncle in the Kidneys, Ureter, Neck of the Bladder, or *Urethra*; or by any other Cause in any other Place about the Organs of Secretion of Urine, and that for any considerable Time, the Person will infallibly be seized by a Fever more or less violent; and though this Fever may be partly ascribed to the violent Pain which follows upon such Obstructions, from such Causes, yet it is not to be doubted, but it is mostly occasioned by the Augmentation of the Mass of the Blood, by such a Quantity of vitious Matter, as necessarily must be accumulated by such a Suppression: And that we may understand how great this Quantity may be, let us consider, that *Sanctorius*, in his 50th Aphor. of the 1st Sect. says, That the Perspiration is to the Quantity voided by Urine in a given time,

as



as 40 to 16. Wherefore from this, and the former cited Aphorism, *viz.* the 6th. it follows, that the daily Repast, or the Quantity voided by the Mouth, is to the Quantity voided by the Urethra, as 8 to 2. Suppose then a Man, who has a Suppression of Urine for 8 days, takes in by the Mouth every day a Pound less, beginning at 8; then by the first Step of the general Calculation, the Blood shall be augmented by 9 Pounds of vitious Matter. It is easy to apply the rest of the Steps of the general Calculation from these *Data* to this Case, and therefore I shall not trouble my Reader with them: Only it may be asked, since the Suppression of the Urine increases the Quantity of the Blood, and thereby causes a Fever, Why, when a Man drinks a vast Quantity of strong Liquor, he is not thereby thrown into one immediately? To this I answer. 1. That many of the Symptoms common to hot Fevers, are very frequently observed in Persons who are drunk, which is a great Confirmation of our Doctrine; and that real Fevers do very often succeed violent Fits of Drunkenness, especially if the Person get much Cold after them, whereby the Glands, contiguous to the Air, are



obstructed. But 2. The Reason why excessive drinking does not always, and immediately throw a Person into a Fever, is, that in the Time, or after the drinking, there is a vast Secretion by Urine. And how great a Quantity this may be, we shall examine thus: From what was before cited from *Sanctorius*, it is evident, a Man in a Day, or 24 Hours, voids by Urine 2 Pounds or 32 Ounces, *i. e.* there are two Pounds of Urine, discernible from 20 Pounds of Blood in a Day, or (taking one Hour with another) the mean Quantity discernible from 20 Pounds of Blood, is about  $1\frac{1}{3}$  Ounce in an Hour: Now suppose a Man has drank six Pounds of a moderately strong Liquor, all these 6 Pounds, except a very small Quantity are discernible Serum; wherefore as 2 Pounds of discernible Serum is to  $1\frac{1}{3}$  Ounce commonly discerned in an Hour, so is 8 Pounds to  $5\frac{1}{2}$  Ounces, which upon this Consideration will be discerned in one Hour; but we generally observe the Pulses of drunken People to go faster, and with greater Force, than when sober, and that at a very extraordinary rate, insomuch, that we may, modestly speaking, say, they go twice as fast, and with  
twice



twice as great Force ; wherefore upon this Consideration, the former Quantity must be multiplied by 4, that is, he will pass by Urine about 20 Ounces at least in an Hour, and though he doth not seern so much every Hour, yet from this Calculation in the general, we may see that in 7 or 8 Hours, the most Part of the said Liquor will be voided. Add to these, that the Perspiration will be augmented at the same Rate, so that from both these Considerations, it is evident, why much drinking does not always, and immediately, cast Men into Fevers.

3. THERE are few who are ignorant of the fatal Effects of a long continued Suppression of the Menstrual Blood in young vigorous Women : But among all these there are none more dangerous than the acute continued Fevers, which it often begets, this it can only do by augmenting the Quantity of the Mass of the Blood ; and how much that may be, we shall now examine : It is very well known that the principal Use of this Blood, is for the Nourishment of the *Fœtus* both when it is in the Belly, and on the Breasts ; and that very little be-  
sides



fides this, is employed, or is necessary to that Purpose, will be evident, to any one, who considers that Nature uses always the most simple, direct, and uncompounded Means for obtaining her Ends; and never employs many where one might be made sufficient, and therefore would never ordain the Suppression of this Matter, the whole time from the Conception, 'till the Weaning of the Child, and the regular Evacuation of the same at other Times, if it were not mainly, and only necessary for this Purpose. Now *Bellini*, in his Treatise *de Motu Cordis*, Prop. 4. assigns 12 Pounds to be a mean Weight to a Human *Fætus*, at the time of its Exclusion, some weighed twice as much: And therefore, in the Suppression of the Menstrual Blood in young healthy Women, the Quantity of the Augmentation of the Mass of the Blood, will not be under 21 Ounces every Month; let us take but a Pound, or 16 Ounces, yet it is evident, (if no other Evacuation be increased, and if the Women be not naturally very lean, and destitute of Plenty of Blood) that this in a few Months, will augment the Blood to such a Quantity as is able to produce a Fever, if any assignable Quantity can do it.

4. LASTLY,



4. LASTLY, as to the Effects of a violent and long continued Costiveness towards a Fever; it must be granted, the *Fæces* do not come from the Blood, and consequently cannot by their Retention augment the Quantity of the same: But it is likewise certain, if they be long suppressed, and a Man take very near his ordinary Refection, these Effects must necessarily follow. 1. The *Fæces* must be intirely percolated, and all the Juices nutritious, or otherwise, must be squeezed out of them into the Lacteals, which is not so in Persons, who are in the Mean betwixt Constipation and Looseness, as healthful Persons ordinarily are, and thus one way the Blood may be augmented thereby. 2. As a Consequence of this; they must extreamly harden, and fill up the Cavity of the Intestines, from the Anus to the Duodenum, and by this Means, the Pancreatic Juice, and Bile, must regurgitate, and consequently the *Ductus Pancreaticus* and *Cholodochus*, be obstructed, and how much the Blood may be augmented by the Obstruction of these, one may guess from the 148 Prop. 2dæ p. Borelli de Mot. Animal. 3. By this hard Repletion of the Intestines, their Glands (which are exceeding numerous) must



must be obstructed, and thereby the Blood augmented by the natural Quantity of their Secretion. Thus, from all these Considerations, it is clear, that the Quantity of the Mass of Blood, may in a short time be hugely augmented by a violent Constipation.

*F I N I S.*





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